Family, Friends and Fertility

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Table of contents

1 Introduction: Family, friends and fertility

1.1 Focusing on social relationships to understand fertility in advanced societies

Since the 1980s, developed countries have witnessed low fertility (Caldwell et al., 2003) together with a 'postponement' transition (Kohler et al., 2002). The decreasing number of children per woman (i.e., quantum), the widespread delay of entry into parenthood (i.e. postponement), and the very recent reversal of the decline in fertility, which is currently occurring in more socially and economically developed countries (Myrskylä et al., 2009; Goldstein et al., 2009; OECD, 2011), have been a central focus. These fertility changes have been investigated extensively, mainly by focusing on an individual's or couple's demographic and socio-economic characteristics (i.e., micro-level determinants such as education, gender and age) and/or on factors related to the cultural and institutional setting in which individuals and couples are embedded (i.e., macro-level determinants such as welfare regimes and social policies). However, existing explanatory approaches tend to neglect the fact that the individual, or the couple, do not make fertility decisions in a vacuum, but are actually influenced by people within their surroundings. As the *linked lives* principle of the life course approach maintains (Elder, 1985), lives are experienced interdependently and individuals develop in synchrony with significant others, who influence their life choices and trajectories (Elder, Johnson & Crosnoe, 2003). We therefore need to take into account that the decision to have a child is shaped by the interaction and exchange of resources with relevant people surrounding the individual or, more often, the couple. Everyday life demonstrates the importance of forces working at a third, intermediate, *meso*-level, that pertains to the web of *social relationships* in which an individual is embedded (i.e., an individual's *social network*)[1]. These network-related forces act in parallel to other individual/couple (e.g., education, age, type of partnership) and contextual factors (e.g., welfare regime), which can enhance or buffer their effects.

Diffusion and social interaction theories (e.g., Bongaarts & Watkins 1996; Montgomery & Casterline 1996) have already highlighted the importance of social relationships for fertility decisions (i.e., meso-level determinants). Moreover, since the 2000s, recognition of the relevance of social networks on childbearing decisions has increased, with scholars more often turning to social interaction effects (e.g., *social multiplier*) to explain fertility differentials across time and space (e.g., Kohler et al., 2002, 2006). However, the role of social relationships and social networks on an individual's fertility decision-making remains understudied with existing research still limited and fragmented. Theoretical efforts to explain how an individual's network of relatives, friends, co-workers, peers (i.e., the so-called *relevant others*) might influence an individual's fertility decision-making can

1. Given the broader definition of social network adopted in this book (i.e., the web of informal relationships that individuals share with relatives and peers), the terms 'social relationships' and 'social network' are used interchangeably.

be found in several studies (Kohler et al., 2001; Bernardi, 2003; Bühler & Philipov 2005). However, these contributions are scattered across independent streams of research and different disciplines. For instance, within demographic literature, we can identify two relatively disconnected bodies of research adopting a meso-level approach. One focuses on the exchange of resources that can affect fertility decisions (*social capital)* with relevant others (e.g., Bühler & Philipov 2005; Philipov et al., 2006). The other examines whether relevant others' opinions and behaviors shape reproductive choices (*social interaction)* and if so, how (e.g., Montgomery & Casterline 1996; Kohler et al., 2001). Although both streams of research investigate the potential manner in which social networks influence fertility behavior, they seem to have developed in parallel. There is no acknowledgement that they focus on complementary dimensions of the same aspect and have not seemed to benefit from one another. Empirical research on social relationships and fertility is also scarce and it often lacks methodological rigor. For instance, studies on social capital and fertility have mostly been focused on Eastern European countries; research on social interaction and fertility has predominantly focused on the use of contraceptive methods in developing countries (e.g., Kohler et al., 2001); and when focusing on advanced societies, study designs are mostly qualitative or have relied on very small samples (e.g., Bernardi, 2003; Bernardi et al., 2007; Keim et al., 2009).

This book is a collection of five articles that have the overarching aim to provide a systematic, multi-dimensional, methodologically rigorous approach to investigate how meso-level factors (i.e., relative to an individual's social network) influence an individual's fertility decision-making. Fertility in advanced societies can be controlled by contraception and having children is usually a matter of choice.[2] More commonly, it is the result of several interrelated decisions. People not only choose whether they want to have a child, but also when, how many, with whom, and within which type of union. Therefore, we need to adopt a multi-dimensional approach in analysing both explanatory network factors and fertility outcomes. Moreover, we investigate the close link between marital and reproductive decisions. Such a multi-dimensional approach forced us to make use of different datasets and explore different methods (see sections 1.5, 1.6 and Table 1.1).

1.2 Research aim

The general aim of this book is to develop a new approach to explain fertility behavior, focusing on meso-level forces, and integrating them with well-established micro- and macro-level fertility determinants. Micro-level factors refer to the characteristics of the individual, or the couple, such as age, education, socio-economic status, and the duration and type of partnership they share. Macro-level forces are the welfare regime, the cultural, economic and institutional setting in which the individual (or the couple) is embedded.

2. We of course acknowledge that fertility behavior can also be the result of unintended pregnancies.

Parallel to these are the meso-level factors. These refer to each dimension that contributes to an individual's social network, that is, the web of informal relationships that individuals share with relatives and peers (McCarty 2002).

A goal is to identify the primary meso-level dimensions that affect an individual's fertility decision-making, as well as investigate the mechanisms with which these dimensions influence choices. This ambitious goal led us to explore several different sides and aspects of an individual's social network. We look into the potentially differing roles that a social network might play on an individual's fertility decision-making by considering it as a source of relevant resources (Chapters 3 and 4), as well as a place where interactions between people mean that they are exposed to and influenced by others opinions and behaviors (Chapters 3-6). We also take into account that a social network is composed of different types of people. Starting from a more general view of an individual's social network, in which we do not distinguish between different categories of network members (Chapter 3), we then focus in on the different types of actors, namely, family, siblings, friends and peers.

In addition to looking at different aspects of an individual's social network, we also adopt a multi-dimensional approach to fertility by investigating the role of the social network on different fertility outcomes. Following the Theory of Planned Behavior (Ajzen, 1991), we consider having a child as a purposive behavior, which results from a rational, intention-based, decision-making process. To study the entire decision-making process from the beginning to the end, we focus on all three aspects that constitute such a process. We look firstly at the formation of the intention to have a child (Chapter 3) then at the realization of that intention by examining the gap between intention and behavior (Chapter 4). Lastly, we consider the overall, final behavior (Chapters 5 and 6). Moreover, because fertility choices entail not only decisions on having children and how many (*quantum*), but also on when to have them (*tempo*), we take both of these dimensions into account. We first examine the intention to have a first or a higher-order birth as well as its realization (Chapters 3 and 4), and then focus on the timing of childbearing (Chapters 5 and 6). Finally, existing literature shows that getting married and becoming a parent are closely linked events, both in terms of their timing (Rindfuss et al., 1988; Manning, 1995) and the life planning they imply (Liefbroer, 1999; Barber et al., 2002). Therefore, we also incorporate this idea into our approach by looking at the interrelation between marital and childbearing decisions (Chapter 6).

The specific aim is to answer the following research questions:

How and to what extent does an individual's web of social relationships influence the formation of his/her intention to have children?

How and to what extent does the family network facilitate or inhibit the realization of the intention to have a(nother) child within a planned time span? And does this differ between first and high-order births?

Does the fertility behavior of friends' and peers' influence the timing of an individual's transition to parenthood?

Does the influence that friends and peers have on fertility change when we consider entry into marriage and into parenthood as two interrelated processes?

1.3 The overarching conceptual framework

The underlying and core assumption of this book, central to each of the four empirical studies (Chapter 3, 4, 5, 6), is that individuals are embedded in and influenced by *social networks*. We are therefore interested in understanding how social networks can influence an individual's fertility decision-making. To investigate this, we aim to integrate the previously disconnected sociological and demographic theories on social capital (Bourdieu 1986; Coleman 1988; Philipov et al., 2006) and diffusion (Bongaarts & Watkins 1996; Montgomery & Casterline 1996) into fertility research. Based on existing research, we identify two main mechanisms that can simultaneously be at play and through which social relationships shape an individual's fertility decision-making. First, the resources and support that an individual has access to as a result of personal relationships might influence his/her decision to have a child. Second, the behavior and opinion of relevant others may also affect an individual's fertility choices. We refer to the former aspect as *social capital* and to the latter as *social interaction*. In this book, we investigate each of these two mechanisms in detail, looking at their specific dimensions, at the role of different actors, and the different channels with which they influence an individual's fertility decision-making.

Social capital

The concept of social capital has been studied extensively in several sociological theories. Sociologists have focused on different aspects of the concept, providing multiple definitions and operationalizations (e.g., Granovetter 1973; Bourdieu 1986; Coleman 1988; Lin et al. 2001; Flap & Völker, 2004, van der Gaag, 2005). Recent fertility research has borrowed the concept, using it to define resources that individuals have access to through reciprocal and trust-based exchange between network members. Resources consist of goods, information, money, the capacity to work, as well as influence, power, or active help (Bühler & Philipov 2005). This body of research, which focuses almost exclusively on Eastern European countries, has shown that network resources are often taken into account during fertility planning and that more supportive network relationships positively influence fertility intentions (e.g., Bühler & Philipov 2005; Philipov et al. 2006; Bühler & Fratzack 2007). Building on this research, we look at the role of two specific *fertility-relevant network supportive resources*, namely emotional support and childcare assistance (Chapter 3). We expect that having these resources enhances positive fertility intentions, although too many resources from different people might be unnecessary or

even have a negative effect on the intention to have a child. We extend existing research, which has only considered the role of social capital in relation to individual micro-level characteristics (e.g., socio-economic status), to investigate its interaction with macro-level factors. To examine whether the effect of social capital on fertility is institutionally filtered, we examine whether the positive effects of emotional support and informal childcare change under different welfare regimes (Chapter 3).

If the effect of specific fertility-relevant resources (i.e., emotional support and informal childcare) is one potential channel via which social capital affects fertility, a second channel lies in the quality and strength of the social ties that generate these resources. The first channel has mainly been investigated in a body of sociological research on social capital (e.g., Snijders 1999), which stresses the importance of looking at resources that are instrumental in reaching a certain goal. Other scholars have instead emphasized the importance of social ties, from which individuals can potentially draw supportive resources (Astone et al., 1999). We investigate this second channel by focusing on how the *quality and strength of family ties* affect the probability of realizing the intention to have a child (Chapter 4). We assume that social capital might not only influence the formation of fertility intention (Chapter 3), but also its realization, thereby affecting the gap between the two (Chapter 4).

In our research, we examine social capital arising from different types of networks. We first look at an individual's broader social network (i.e., not only close family members, but also other relatives, friends, neighbours, peers, etc.). We then specifically focus on the family of origin, which is most likely to be the main and long-term source of crucial supportive resources (e.g., financial support, childcare assistance).

Social interaction

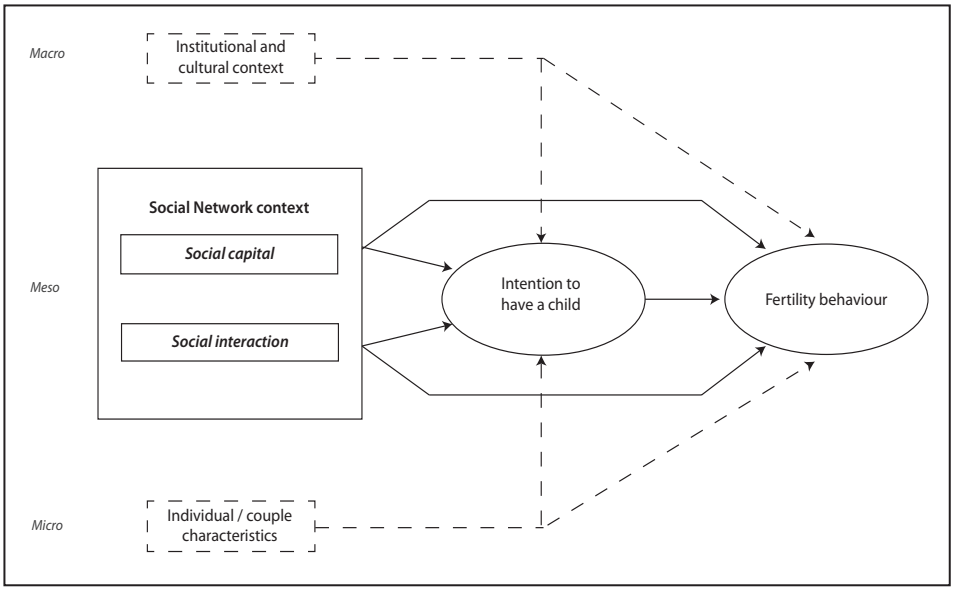
Building on previous studies (e.g., Bongaarts & Watkins 1996; Montgomery & Casterline 1996), we define social interaction as the general mechanism via which relevant others' (e.g., relatives, friends, peers, colleagues) opinions and behaviors affect an individual's choices. The importance of social interaction on an individual's fertility decision-making has been increasingly acknowledged (e.g., Kohler 2001; Bernardi, 2003). At the macro-level, researchers have often turned to diffusion and social interaction effects to explain the persistent diversity of fertility behavior between geographical areas or over time (Kohler, Billari & Ortega, 2002; 2006). As an example, these effects are assumed to amplify the behavioral impact of certain socio-economic and institutional changes (i.e., the so-called *social multiplier*, Billari, 2004). At the micro-level, different disciplines (e.g., sociology, demography and economics) have focused on different channels through which social interaction might work. By bringing together the contributions from these different disciplines we identify 5 main social interaction channels.

A body of sociological and demographic research has identified two channels through which relevant others matter for fertility choices: *social influence* and *social learning* (e.g., Montgomery & Casterline 1996; Kohler et al., 2001). Social influence references to consensus in peer groups that constrain attitudes and behaviors, whereas social learning relates to how individuals gain knowledge from others. Another channel that has been highlighted by more qualitative demographic research (Bernardi, 2003) is *social pressure,* defined as the individual's perception of what relevant others approve or disapprove. Economic research provides two other possible complementary channels through which social interaction might work: *cost-sharing dynamics* and *network externalities* (Kuziemko, 2006; Balbo & Barban, 2012). Cost-sharing dynamics refers to the opportunity for people consuming similar goods or experiences to share the costs and uncertainty associated with it. Network externalities are the increase in benefit, or surplus, that an individual derives from an experience when the number of other people consuming it increases (Katz & Shapiro, 1985). These two mechanisms emphasize two different aspects of the same sharing process: the former focuses on the cost and the latter stresses the benefit. A certain experience not only generates a particular value in itself, but it can also produce additional value when 'consumers' of such an experience interact one with another. This is called the synchronization value and it is the essence of a sharing process (Liebowitz & Margolis, 1995).

This book investigates all five of the aforementioned channels. We refer to social pressure when assuming that an individual's perception of whether relevant others think they should have a child shapes their fertility intentions (Chapter 3). Social influence, learning, network externalities and cost-sharing dynamics are the theoretical basis used to predict whether and when an individual has a child based on the fertility behavior of siblings (Chapter 4), friends and peers (Chapter 5 and 6).

As social capital, we investigate social interaction in relation to different fertility outcomes, namely intentions (Chapter 3), behavior (Chapter 5 and 6) and the gap between them (Chapter 4), assuming that social interaction shapes the entire decision making-process. We look at both quantum (having a(nother) child, Chapter 3 and 4) and tempo dimensions (the timing of having a child, Chapter 5 and 6). We take into account social interaction with different actor members. We first adopt a general approach, in which we consider social pressure coming from different possible types of relevant others (i.e., close family members, relatives and friends). We then focus on a specific and primary category of family member, siblings. Finally, we examine the role of current friends and former high-school classmates, who we define as peers. In this way, we look at social interaction coming from both ascribed and voluntary relationships. A general outline of the conceptual framework of this book is shown in Figure 1.

Figure 1: Overarching conceptual framework



1.4 Overview of the five studies, research questions and main hypotheses

This section provides an overview of the five chapters that will follow in this dissertation. We begin by summarising a review of contemporary fertility research (Chapter 2), followed by a description of the main hypotheses of the four empirical studies (Chapter 3-6). More information about data, analytical methods, main findings and specific contributions of each study are provided in sections 1.5-1.7. A general outline of the four empirical chapters can be found in Table 1.1, in which the research questions, main explanatory and outcome variables, data, method and findings of each study are summarized.

Chapter 2 provides an overview of the current state of fertility research, positioning existing meso-level research within this broader spectrum. Each of the remaining empirical chapters (3-6) has been developed in relation to the previously outlined overarching conceptual framework, thereby covering a specific aspect. Note that all studies were written in the form of a journal article and therefore designed to be read in isolation from each other. As a result, some degree of overlap and repetition is inevitable.

Chapter 2: Fertility in advanced societies: a review

To set the stage for the empirical studies that follow, we first engage in a systematic and comprehensive review of existing fertility research. This study is an essential starting point to understand what is known and what we still need to discover about fertility. In this review, we classify existing research according to the main factors used to explain fertility,

namely, the determinants of fertility. These factors are classified according to the *analytical level* at which they operate (micro, meso or macro factors). While aiming to offer a useful categorization of existing fertility research, the review also highlights the limited amount of research at the meso-level, that is, on social relationships. We also attempt to place this latter stream of research within the larger context of fertility research, identifying possible links with work at the micro- and macro-level.

Chapter 3: The effects of social capital and social pressure on the intention to have a second or third child in France, Germany, and Bulgaria, 2004–05

The aim of Chapter 3 is to investigate whether perceived social pressure and received social capital from kin and peers influence an individual's intention to have a second or third child. After defining social pressure as the individual's perception of what relevant others approve or disapprove (Bernardi 2003), we assume that the individual uses these perceptions to evaluate the social costs and benefits of acting on or ignoring the relevant other's opinions. We hypothesize that the greater social pressure exerted on an individual to have another child, the greater the likelihood is that they intend to have another child. Social capital is operationalized in terms of received emotional support and informal childcare assistance, two fertility-relevant resources that can be drawn from an individual's personal network (Hank & Kreyenfeld 2003; Bühler & Philipov 2005). Specifically, we look at the number of providers of each resource. Two alternative hypotheses on the relationship between social capital and fertility intentions are tested. On the one hand, we assume that returns are proportional to the number of providers of each resource. This means that a larger number of providers of a certain type of support (i.e., emotional support and informal childcare) equates to a higher intention to have another child. On the other hand, building on social capital studies, we argue that many providers entail more obligations, resulting in diminishing returns from reciprocity (e.g., Borgatti et al., 1998; Snijders, 1999). Therefore, we might also expect a curvilinear relationship between social capital and fertility. As such, we also considered the hypothesis that the presence of only one provider for each relevant resource leads to the highest likelihood that the individual intends to have another child.

In addition, we are particularly interested in uncovering whether the above mentioned mechanisms are institutionally filtered. Adopting a cross-national comparative approach, we examine whether different welfare regimes influence the individual's need for support as well as his or her perceived pressure from the personal network, and thus their influence on fertility behavior. Specifically, we envision that in familistic countries, where the state and the market provide limited childcare provisions, with families bearing the principal responsibility for their members' welfare (Esping-Andersen, 1999), the effect of social pressure and social capital on the intention to have another child is stronger than in non-familistic countries.

Chapter 4: The influence of the family network on the realisation of fertility intentions

Chapter 3 offers a broader contextualization of the role of social relationships on fertility by investigating the interplay between meso-level network forces and macro-level contextual factors whereas Chapter 4 focuses on the specific institutional context of The Netherlands. In this study, we exclusively look at the family network, aiming to deepen the knowledge of how the family network influences an individual's fertility decision-making. The specific dimension of fertility we focus on in this chapter is the gap between intention and behavior, by studying the realization of the intention to have a(nother) child. As in the previous study (Chapter 3), we consider an individual's network, which in this case is limited to the family network, as a place where the social exchange of resources, as well as social interaction, occur. In this study we aim to uncover whether having high family social capital, operationalized in terms of strength and quality of family relationships from which an individual can draw useful resources, facilitates or inhibits positive fertility intentions. Having strong supportive family ties aids in reducing uncertainty and also the costs related to childbearing, thereby enhancing the realization of positive fertility intentions (Bühler & Philipov 2005; Bühler & Fratzack 2007). Conversely, following a 'satisficing' strategy (Simon 1956; 1957), individuals who are already satisfied with their existing family relationships lack the urgency to invest in their family network and would therefore be less likely to realize their childbearing intentions within the planned time span. Moreover, we assume that the family network is more influential in the decision to have higher-order births than in the first birth.

The second goal of this study is to examine the effect of intra-familial interaction on the realization of fertility intentions. We operationalize such an interaction as intra-sibship mechanisms. We assume that cross-sibling effects on fertility operate as both a signal of family attitudes and values that are reinforced by a sibling's behavior and as a consequence of social learning and influence processes that stem from observing siblings as role models and as a source of information (Axinn et al., 1994; Lyngstad & Prskawetz, 2010). We therefore hypothesize that individuals who have siblings with a young child (under the age of 12) are more likely to realize their fertility intentions.

Chapter 5: Does fertility behavior spread among friends?

Chapters 5 and 6 focus exclusively on social interaction outside the family network, and more specifically, between friends. Studies on the influence of friendship on fertility decision-making are lacking. Theoretical as well as empirical efforts to identify processes through which social interactions operate remain scarce.

Chapter 5, adopting a dyadic approach (i.e., studying dyads of friends), aims to investigate whether and how an individual's transition to parenthood is affected by a friend's fertility behavior. Focusing on young American adults and their transition to first birth, we elaborate on possible mechanisms underlying fertility diffusion effects among

friends. We assume that a friend's childbearing experience might be an important source of information (*social learning),* in addition to the fact that friends might be role models or comparison groups (s*ocial influence).* Moreover, by synchronizing childbearing with other friends, an individual might make the parenthood experience more enjoyable (*network externalities*) and reduce the costs and risk of being left behind by those friends who already have a child (*cost-sharing dynamics*). In Chapter 3 we examined social interaction effects on the likelihood of having a child, whereas in this study we focus specifically on the timing of childbearing. We hypothesize that an individual with a friend who becomes a parent will experience parenthood sooner.

Building upon existing studies of cross-sibling effects on fertility (Kuziemko, 2006; Lyngstad & Prskawetz, 2010), we envision that cross-friends effects on an individual's fertility behavior are short-term and inverse U-shaped. We anticipate an individual's rate of entry into parenthood will increase in the period directly after a friend has a child, and after reaching a peak, will then decrease. In this way, people can put cost-sharing dynamics into practice.

In addition to expanding the theory on possible cross-friend interaction mechanisms, another aim of this chapter is to develop an analytical strategy to properly identify and correctly model social interaction effects. Making use of the survey design, we propose an innovative way to disentangle social interaction effects from possible confounding factors (i.e., contextual and selection effects). A detailed explanation of the method is presented in section 1.6.

Chapter 6: Friend and peer effects on entry into marriage and parenthood: A multiprocess approach to interrelated family-formation processes

Chapter 6 focuses on the interplay between marital and fertility behavior, examining how cross-friend effects influence the two behaviors, both as independent and interrelated transitions. In the demographic and sociological literature it is well established that getting married and having the first child are closely linked events, both in terms of the timing (Rindfuss et al., 1988; Manning, 1995) and the life planning they imply (Liefbroer, 1999; Barber et al., 2002). We therefore consider it important to address the relationships between these two processes.

In this chapter, we again focus on the timing of a first birth but here we also link it to first marriage among young American adults. Following the same theoretical assumptions described in Chapter 5, we assume that friends' behaviour might not only influence an individual's fertility decision, but also their decision to marry. These cross-friend effects are assumed to be linear and proportional to the number of friends who experience a certain event. More specifically, we hypothesize that an individual's risk of getting married (or having a child) increases as a linear function of the number of friends who get married

(or have a child). In addition to friends, we also include peers in our analysis. Peers are defined as former high-school classmates who are not friends. Applying the same methods used for exploring the influence of friends, we look at whether the marital and fertility behavior of peers has an influence on an individual's marital and fertility behavior. Peers are assumed to come from the same social settings and as such have been exposed to the same contextual forces. In this way, we can assess whether contextual effects matter to an individual's marital and fertility choices.

Having looked at marriage and childbearing as two independent events, we then more realistically assume that these two behaviors are interrelated. We look at transition to marriage and first birth as joint outcomes of the same underlying family formation strategy, assuming that marital and childbearing decisions are simultaneously affected by unobserved characteristics of the individual. With this interrelation in mind, we aim to explore whether there are any observable changes in cross-friends effects on an individual's fertility behavior.

We adopt an analytical strategy similar to the one developed in Chapter 5 in order to disentangle social interaction effects from confounding effects. In addition, we added a further element of complexity to model the marital and fertility decisions as two simultaneous and interrelated processes (see methods in section 1.6).

1.5 Data

With the exception of Chapters 5 and 6, which shared the same dataset (Add Health), each empirical study uses a different data source. This choice stemmed from the fact that the research questions were developed first, followed by a need to find suitable data to answer these questions. This diversity turns out to be a valuable ingredient to this book. Using different datasets from a diverse group of countries (namely, Germany, France, Bulgaria, The Netherlands and the U.S.A) allowed us to study and contrast different socio-economic and institutional contexts, which of course cannot be neglected in these investigations. Moreover, having the opportunity to examine the influence of social relationships on fertility in different settings helps us to identify more 'universal' rather than country-specific mechanisms.

All of the datasets we use are publicly available, large-scale datasets. Specifically, in Chapter 3 we use the Wave I of the Generations and Gender Survey (GGS), that allows us to adopt a cross-country perspective; in Chapter 4 we use data from Wave I (2002-2004) and 2 (2007) of the Netherlands Kinship Panel Study (NKPS), focusing on the Dutch context; in Chapter 5 and 6 we use data from all four waves of the National Longitudinal Study of Adolescent Health (Add Health), which is an American panel study. The data used in each study is also summarized in Table 1.1, and a detailed description can be found in the method section of each empirical chapter.

1.6 Methods

The different analytical strategies applied in each empirical study were chosen to enable us to answer each research question and test our hypotheses. As with the use of different datasets, methodological diversification likewise enriches this book. It provides us with an opportunity to apply several methods to a field, namely social relationships and fertility, which still lacks a satisfying and rigorous body of empirical research. Aside from a lack of suitable data, the other main reason why there are so few empirical, quantitative studies on the impact of social network on fertility is the difficulty in modelling social interaction processes. As highlighted by Manski (1993, 1995), social interactions are endogenous processes (i.e., the choice made by one individual depends on the actions taken by others) which are difficult to identify and disentangle from contextual (i.e., people might act in a similar way because they come from the same social setting) and selection effects (i.e., people may behave similarly in virtue of the fact that they share the same characteristics). During our investigations, we faced some challenges that we attempt to overcome by proposing some methodological innovations, presented in Chapters 5 and 6.

In Chapter 3, which focuses on the impact of social pressure and capital on fertility intentions in a cross-country perspective, we estimate binary logistic regression models of the probability of intending to have a second or third child within three years. To explore differences between women and men in the relationship between personal network and fertility, we estimate models separately for men and women. We pool together the analysis of the three investigated countries, using country-dummies to control for between-country variation. We then include interaction terms between our social pressure and social capital variables and country-dummies to test whether differences in institutional arrangements between the countries affect the intensity of the effects of social pressure and social capital on childbearing intentions.

In Chapter 4, we are interested in investigating factors that facilitate or inhibit the intention to have a(nother) child. Therefore, our outcome variable is the likelihood of realising the intention to have a child within three years. We address the problem of potential selection bias, which comes from only studying those who have positive fertility intentions, by estimating a probit model with sample selection.

In Chapter 5 we engage in a discrete time (probit) event history model with random effects at the dyadic level in order to uncover whether a friend's childbearing increases the risk of the other friend in the dyad becoming a parent as well. Such a risk, or hazard, is our outcome variable. As mentioned above, the main methodological challenge is to properly identify and model social interaction effects so they can be distinguished from possible contextual and selection effects. To control for contextual effects we implement an analytical strategy that includes, in addition to dyads of friends, dyads of former classmates (i.e., peers), who come from the same social setting. Selection is taken into account by use of a simultaneous equation model. In this way, we control for possible selection stemming from

Table 1. Overview of the four empirical chapters (Chapter 3-6) of the book

Chapters and Research Questions	Outcome(s) and Predictor(s)	Data and Method	Main Findings
Chapter 3 To what extent do social pressure and social capital influence an individual's intention to have a second or third child? Is the social capital's effect on an individual's fertility intention directly proportional to the number of support providers within an individual's personal network? In other words, does the presence of only one provider of support within an individual's personal network lead to a higher likelihood that the individual intends to have another child? Are the effects of social pressure and social capital institutionally filtered? More specifically, is the effect of social pressure and social capital stronger in familistic countries?	*Outcomes*: Intention to have the second or third child within three years *Predictors*: perceived social pressure to have another child; received emotional support; received informal childcare	*Data*: GGS Wave I, 2004-2005 *Countries*: France, Germany, Bulgaria *Method*: Logistic regression	The greater the perceived social pressure and the more the people providing emotional support, the higher the likelihood of intending to have children. The social pressure effect is stronger in more familistic countries. German men are more likely to have another child when they receive childcare assistance from only one person.
Chapter 4 Does the family social capital facilitate or inhibit the realization of the intention to have a(nother) child within the planned time span? Does this effect differ between first and high-order births? Does the recent childbearing and child rearing experience of a sibling facilitate or inhibit the realization of the intention to have a(nother) child within the planned time span?	*Outcomes*: Realization of the intention to have a child within three years (i.e., likelihood of having a child within the planned three years) *Predictors*: strength and quality of family ties; presence of a sibling with a young child (under age 12)	*Data*: NKPS Wave I (2002-2004) and II (2007) *Countries*: The Netherlands *Method*: Probit with sample selection	For individuals who already have one child, the higher the family social capital, the lower the probability to realize fertility intentions. Having at least one sibling with a young child increases the likelihood of realizing fertility intentions.

Chapter 5 Does a friend's childbearing increase an individual's risk of becoming a parent? How is this cross-friend effect shaped? Is it a short-term and inverse U-shaped effect?	*Outcomes*: an individual's risk of having the first child *Predictors*: time varying covariate measuring when a friend has a child, or, alternatively, a set of dummy variables indicating whether a friend had a child respectively in the last 11 months, 12-23 months ago, 24-35 months ago, and more than 36 months ago.	*Data*: Add Health Wave I-IV (from 1995 to 2009) *Countries*: U.S. *Method*: discrete time (probit) event history model; simultaneous equation model	A friend's childbearing increases an individual's risk of becoming a parent. An individual's risk of having the first child increases immediately after a friend's childbearing, it reaches a peak after about two years, then decreases.
Chapter 6 Does an individual's risk of becoming a parent increase when the number of friends who have a child increases? Does an individual's risk of getting married increase when the number of friends who get married increases? Are the risks of getting married and of becoming a parent correlated? Do cross-friend effects on fertility change when we consider entry into marriage and into parenthood as two interrelated processes?	*Outcomes*: an individual's risk of having the first child; an individual's risk of getting married *Predictors*: time varying covariate measuring the number of friends who over time become parents; time varying covariate measuring the number of friends who over time get married	*Data*: Add Health Wave I-IV (from 1995 to 2009) *Countries*: U.S. *Method*: discrete time (cloglog) event history model; multiprocess model	The larger the number of friends who have a child, the higher an individual's risk of becoming a parent. No such cross-friend effects are found for the risk of getting married, which is only affected by contextual factors. Even when considering marriage and parenthood as two interrelated processes, cross-friend effects on fertility are strongly significant.

the idea that individuals might remain friends with certain former classmates because they shared similar family attitudes.

In Chapter 6 we adopt a similar strategy to the one implemented in Chapter 5. The main difference in this study is that we do not adopt a dyadic approach. We use discrete time (cloglog) event history models to predict the risk for an individual to get married and become a parent, respectively. We control for contextual effects including, as in Chapter 5, non-friend former classmates. Therefore, in addition to the number of friends who get married or have children, we also include the number of former classmates who experience these events. In this chapter we are specifically interested in testing and then controlling for possible unobserved factors that simultaneously influence marital and childbearing behavior. To do so, we engage in a multiprocess model, in which we jointly estimate the two cloglog models predicting entry into marriage and entry into parenthood, respectively.

1.7 Main findings, conclusions and contributions

Existing research on social relationships and fertility is still limited and, although it has recently been growing, several innovations are still possible. Each empirical study (Chapter 3-6) has therefore been carried out with the specific purpose of extending existing research in a direction that has so far been understudied or not investigated, aiming at uncovering a different aspect of how social networks and interpersonal relationships affect an individual's fertility decision-making.

We provide evidence that social relationships play a crucial role in fertility decisions. Specifically, our research shows that an individual's social network is an important source of supportive resources, which are taken into account by the individual when forming their fertility intentions (Chapter 3), and in realizing such intentions (Chapter 4). Moreover, our findings show that individuals are influenced by the opinions (Chapter 3) and behavior of relatives (Chapter 4), friends and peers (Chapter 5 and 6).

Chapter 3 shows that for both sexes, social pressure from parents, relatives and friends has a strong positive effect on fertility intentions, which is in line with previous findings (e.g., Billari et al. 2009). The results for social capital are more mixed and resource-specific: informal childcare support appears to have little effect on fertility intentions, but we find that the higher the number of people providing emotional support, the greater the likelihood that an individual intends to have another child. This latter result seems to show a linear relationship between emotional support and the probability of intending to have another child, suggesting the presence of an 'insurance effect'—when one confidant is not available, the respondent can rely on others. Another possible interpretation is that having several people with whom an individual can discuss personal matters is symptomatic of a social environment conducive to sharing and supporting child-related worries. The most interesting finding of this study is that the effects of social pressure and informal childcare support on an individual's intention to have another child seem to vary according to the

socio-institutional context in which that individual lives. Specifically, we find that in more familistic countries (e.g. Bulgaria and Germany), the effect of social pressure is stronger. In these contexts, caring for a child is by and large, a responsibility of the whole family and personal network. As a result, the individual relies heavily on his or her personal network, thereby being more exposed to the network social pressure.

Chapter 3 contributes to the literature on social relationships and fertility in two main ways. First, it adopts a cross-national perspective in investigating the effect of the personal network on fertility to uncover whether the effect of social pressure and social capital is institutionally filtered. Earlier studies on this topic have focused almost exclusively on ex-communist Eastern European countries (Philipov & Shkolnikov 2001; Philipov 2002; Philipov et al. 2006; Bühler & Fratzcak 2007) and they have investigated social capital exclusively in relation to individual factors (Schoen et al. 1997; Buhler & Philipov 2005; Philipov et al. 2006). Our study extends this stream of research by including two Western European countries (France and Germany), and by showing the importance of the interplay between the role of institutions and social relationships. The second contribution of this study is made by integrating sociological approaches to resource-based social capital in fertility research (Snijders, 1999). Previous studies on the effect of social capital on fertility have often assumed an increasing linear relationship between the number of providers of a certain supportive resource and the likelihood of having a child. Inspired by some sociological theories (e.g., Snijders, 1999), we propose a more nuanced relationship between the size of the network and fertility intentions. We examine both the positive and the negative effects of the number of resource providers, and the non-linear shape of social capital effects in relation to the number of providers for each resource.

Chapter 4 provides evidence that an individual who possesses high family capital, in the form of strong and tight family ties, and already has one child, is less likely to realize his/her intention to have another child, at least in the planned time span (in our case, within three years). This result might be explained by the fact that individuals already feel socially fulfilled or satisfied with their social network and opt for an adequate satisficing solution (i.e., adoption of a 'satisficing' strategy, Simon 1956; 1957). Perceived high levels of family social capital might result in the lack of need for an individual to invest in their social network, which in turn deters them from having another child. The other revealing finding of this study is that having at least one sibling who has a young child (under the age of 12) is associated with a higher probability of realising one's own intention to have a first child. This suggests that a sibling's recent childbearing and childrearing experiences facilitate a translation of behavior to an individual's positive fertility intentions, within the planned time span.

This effect is most likely attributed to two main underlying mechanisms. First, the parental experience of a sibling could reinforce and intensify the transmission of positive parental values and attitudes towards childbearing. Second, having the opportunity

to observe intimate members of one's network, such as siblings, who experience this pivotal life event and learning from them, may reduce the degree of uncertainty that the transition to parenthood brings about. We can conclude that family settings in which the individual is surrounded by childbearing experiences of intimate others, affords them the opportunity to share information and feelings, which in turn facilitates the translation of their positive fertility intention into behavior.

The first contribution of Chapter 4 is the focus on the realization of the intention to have a(nother) child. Existing studies on social capital and fertility have focused on fertility intentions (e.g. Bühler & Philipov 2005; Philipov et al. 2006), whereas intra-familial interaction, in the form of cross-sibling effects, has been investigated for its influence on the overall likelihood of having a child (e.g., Lyngstad & Prskawetz 2010), but not as a factor inhibiting or facilitating the realization of positive fertility intentions. We looked specifically at those people who have positive fertility intentions, while assessing and controlling for possible selection bias, engaging in a probit with sample selection. The second contribution of this chapter to the literature is the empirical test of such selection bias, which is found to be negligible. Studies that have examined the realization of fertility intentions have not formally tested this form of bias (Spéder & Kapitany 2009, REPRO project, work package 4, 2010). Finally, a third contribution of this study, and similar to Chapter 3, is that we look at both positive and negative effects on fertility of social capital, operationalized in terms of strength and quality of family ties. So far, fertility research has looked mainly at social capital as a force that promotes fertility. In contrast, we show that strong family ties might in fact deter the realization of the intention to have another child.

Chapters 5 and 6 contribute to the further development of a still meagre empirical body of research on social interaction effects on an individual's fertility decision-making. Although recently there have been signals of a growing interest in a more rigorous quantitative approach in this field, there remain very few studies that have engaged in quantitative analyses. Specifically, the existing studies have shown that social interactions among siblings (Kuziemko, 2006; Lyngstad & Prskawetz, 2010), co-workers (Hensvik & Nilsson, 2010; Ciliberto et al., 2010) and peers belonging to the same ethnic-religious group (Manski & Mayshar, 2003) shape the individual's fertility decisions. However, to our knowledge, there has been no research on social interaction among friends and its effect on fertility. In current individualized societies where voluntary relationships, such as friendships, have gained increasing importance and might even be more influential than kinships, this gap in knowledge needs investigation. Indeed, this is the main contribution of Chapter 5 and Chapter 6, in which we engage in a rigorous quantitative analysis of cross-friend effects on an individual's fertility behavior.

The results of Chapter 5 show that, net of selection and contextual effects, a friend's childbearing will positively influence an individual's risk of becoming a parent. In line with previous findings on cross-sibling effects on fertility (Kuziemko, 2006; Lyngstad &

Prskawetz, 2010), we find cross-friend effects to be short-term and inverse U-shaped. Specifically, an individual's risk of childbearing starts increasing immediately after a friend's childbearing, it reaches a peak around two years later, and then decreases. Synchronizing the transition to parenthood with that of a friend, by having children around the same time, might reduce the relational costs that such a life-changing event brings about (cost-sharing strategy). Moreover, the non-linear effect of cross-friend interaction on first birth might be explained by the pattern of happiness surrounding the birth of a first child. Pouwels (2011) has shown that, in the year before and after the first childbirth, parents experience a sharp increase in the level of happiness. Happiness seems however to drop some months after the delivery of the child and new parents are found to be less happy than before the birth, for a long time. This curvilinear relationship between happiness levels and childbearing seems to translate into a similar influence effect on the other friend's fertility, with a lag time of 2 years resulting from the time necessary to conceive and have a child (Gnoth et al., 2003). It could be that individuals are positively affected by seeing their friend happier because of the birth of a child, and therefore they become more willing to have a child as well. Conversely, by seeing a friend struggling as a new parent, individuals might become (more) aware of the difficulties associated with childbearing and childrearing, thereby reducing their own likelihood to have a child. Next to these immediate and inverse U-shaped cross-friend effects, we find contextual effects, non-friend former classmates, to be significant only in the long term. We interpret this as an indication of social pressure. With an increase of age, women who see many of their peers having children may feel pressured to have one as well.

Chapter 5 provides two main contributions to the literature on social interaction and fertility. The first one is at a theoretical level and consists in integrating insights of social interaction processes from sociology and economics, in order to have a richer and more comprehensive knowledge of how social interaction works and might affect an individual' fertility decision-making. The second contribution is at the methodological level. In this study, we propose an innovative way to identify social interaction effects in order to disentangle them from contextual and selection effects. We elaborate on the analytical strategy we implement, which is based primarily on the exploitation of the survey design.

Results of the analysis we carried out in Chapter 6 confirm the main finding of Chapter 5, that is, the relevance and significance of cross-friend effects on fertility. Instead of adopting a dyadic approach, here we focus on an individual's larger group of former classmates, who are divided into friends (i.e., former classmates who are also friends) and peers (i.e., non-friend former classmates). We assume the contagion to be linear on the absolute number of friends and peers who experience the transition to parenthood (Pastor-Satorrás & Vespignani, 2001).

Results show a strong and significant cross-friend effect on entry into parenthood, with no impact of friends for marriage. In fact, an increasing number of friends who

get married do not seem to raise an individual's propensity to marry, unless that person comes from a religious family. This latter finding is likely due to the higher levels of social pressure and social recognition that marriage brings in these religious groups.

Marriage and parenthood are associated with very different levels of uncertainty and costs, with the latter transition being much more 'costly' than the former. A central finding is that because peers have a strong impact on marriage and no effect on parenthood, social influence or pressure appears to be the central explanatory mechanism for marital choices. For entry into parenthood, however, cross-friend effects are paramount, which is related to social learning, but also cost-sharing dynamics and the benefit of 'pooling' parental resources in the form of network externalities.

In this study, we also consider transition to marriage and parenthood as two interrelated processes. We find a significant positive correlation between these two life-course decisions, which means that there are common unobserved inter-individual factors (i.e., unobserved heterogeneity) affecting both marital and childbearing behavior. The most striking finding of this study is that, even when taking this cross-process unobserved heterogeneity into account, cross-friend effects on an individual's risk of becoming a parent remains strong and significant.

Chapter 6 contributes to existing research on social interaction and fertility by studying and extending friend and peer effects not only on an individual's transition to parenthood but also on the transition to marriage. Existing research has almost exclusively studied social interaction in relation to fertility choices, neglecting other crucial and interrelated life-course transitions, such as union formation. We found divergent results from social interaction effects on the entry into marriage and into parenthood, with cross-friend effects being significant only for fertility, whereas marital choices were affected only by contextual forces. These findings suggest that a more thorough knowledge of social interaction processes on the different life-course decisions is needed.

The second contribution is empirical in nature. We not only considered entry into marriage and parenthood as two independent transitions, which is often the case in existing literature, but we also modelled them as two joint outcomes of a common underlying family-formation strategy. This is in line with existing literature that has demonstrated marital and fertility decisions are highly interdependent, because they are both simultaneously affected by common unobserved inter-individual heterogeneity (Lillard, 1993; Upchurch et al., 2002 Baizan et al. 2003, 2004; Steele et al., 2005, 2006, Aassve et al., 2006). By focusing on the conventional pathway, in which an individual first experiences marriage followed by parenthood, we adopt a multiprocess model to uncover a positive correlation between unobserved subjective factors that simultaneously affected the decision to marry and become a parent. Controlling for such cross-process unobserved heterogeneity, and for possible preceding cross-friend effects on marital

behavior, does not change the strong impact that interaction among friends has on an individual's fertility behavior.

Each of the chapters in this book sheds light on a different side of the social network and focusses on a specific fertility dimension. The overall, general conclusion we can draw from the research presented here is that the social network is a crucial driving force shaping the entire fertility decision-making process, from the beginning (i.e., the formation of the intention to have a child) to the end outcome (i.e., the final behavior), in its quantum (i.e., whether having a(nother) child) and tempo (the timing of having a child) components. The way the social network influences fertility is not one dimensional. In this book we show that there are several dimensions, channels, mechanisms and actors that we need to take into account when investigating the impact of social networks on fertility.

1.8 Limitations and suggestions for further research

Limitations of existing studies are often the basis for suggesting further research. Therefore, this section describes the main limitations and constraints we faced in the analysis undertaken for the four empirical studies of this book, while providing some possible directions for future research.

The main and more serious constraint we encountered while studying the role of social relationships and networks in an individual's fertility decision-making is the lack of suitable data. Although innovative designs adopting a kinship and/or network-based approach (e.g. the Add Health study in the U.S. or the Netherlands Kinship Panel Study) have recently been developed and large-scale surveys (e.g., the cross-national Generations and Gender Survey) have begun to include measurements of social capital and social pressure, these are unfortunately rather isolated examples. A systematic, detailed and comprehensive collection of quantitative network data is still missing. Of course, collecting network data is very complex and difficult, as it is either a large burden for the respondent (in case of an ego-centered network, filling in the survey can be very time-consuming) or very expensive to set up a survey design which includes sampling members of each respondent's network (in case of a complete network design). However, given the importance of social relationships on fertility, we hope the evidence in this book provides support in favour of more complete network data being collected. A network-based approach should be incorporated in panel, large-scale, and cross-national surveys. Panel network data is needed to enable control for selection, and other possible source of endogeneity. In this way, causal relationships can be identified. Large-scale samples would allow us to generalize findings and network cross-national data would make it possible to compare the effects of social relationships on fertility in different socio-economic and institutional settings. These approaches will enable further insights on the interplay between meso- and macro-level driving forces, possibly engaging in a multilevel analysis to identify universal network effects from context-specific ones. Another possible way to

overcome the lack of network data could be to make use of online social network data. However, ensuring this potentially massive source of data is scientifically reliable will require great effort.

In addition to a more accurate analysis of network composition (i.e., relative to individual characteristics and behaviors of the network's members as well as availability of resources), a structural analysis of the network would be of value (i.e., relative to the ties between the network's members, which define the network's structure). This would allow assessment of the network of influence, and to identify strong and weak ties, as well as the role of specific subgroups. Studying both compositional and structural aspects of the personal network might reveal further mechanisms through which fertility is affected. The integration of complex network analysis techniques into demographic research should be considered.

Future research on social capital and fertility would also benefit from a more well-established and specific definition as well as operationalization of the concept of social capital. Social capital is a complex and multidimensional concept, therefore making it hard to define and measure. Diffuse definitions remain meaningless and efforts should be made to determine an unambiguous definition and more consistent measurements. For instance, it would be useful to develop and test reliable social capital multi-item scales. This would make findings of different studies more comparable, also across different countries. For example, in Chapters 3 and 4 we used different measures of social capital and therefore we cannot directly compare how this affects fertility intentions and their realization.

In studying the effects of social interactions among friends on an individual's fertility behavior using the Add Health study, in Chapters 5 and 6, we were unable to include men in our analyses, because fertility data on men are often unreliable (Schoen et al., 2007). Our hope is that future research will investigate whether the effects of social interaction differ for male and female fertility decision-making. In Chapter 6, we extend the theories and empirical strategies used to investigate the effects of social interaction on fertility by applying them to another crucial life-course event: the transition to marriage. We find very different effects for the two events, that is, marriage and childbearing. Further studies should examine how meso-level factors impact on other life-course decisions and behavior, in order to provide a more comprehensive view of how social relationships affect an individual's overall life-course trajectory.

Finally, fertility research would benefit from a more multidisciplinary analysis of social networks. Social networks and interpersonal relationships have been investigated in different disciplines. By crossing disciplinary boundaries and integrating the insights from different subject areas, we could get a more thorough knowledge of how meso-level forces influence an individual's fertility decision-making.

2 Fertility in advanced societies: A review of research

This paper provides a systematic review of fertility research in advanced societies, societies in which birth control is the default option. The central aim is to provide a comprehensive review that summarizes how contemporary research has explained ongoing and expected fertility changes across time and space (i.e., cross- and within-country heterogeneity). A secondary aim is to provide an analytical synthesis of the core determinants of fertility, grouping them within the analytical level in which they operate. Determinants are positioned at the individual and/or couple level (micro-level), social relationships and social networks (meso-level); and, by cultural and institutional settings (macro-level). The focus is on both explaining quantum aspects of fertility, but also the timing of fertility, with a particular focus on the postponement of childbearing. The review incorporates both theoretical and empirical contributions, with attention placed on empirically tested research and whether results support or falsify existing theoretical expectations. Attention is also devoted to causality and endogeneity issues. The paper concludes with an outline of the current challenges and opportunities for future research.

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2.1 Introduction

Fertility has been a central topic of research within the discipline of demography, but has also achieved considerable interest within sociology, anthropology, economics, medicine and psychology. During the last two decades, research about fertility in advanced societies — societies in which birth control is the default option — has flourished. It is not surprising, therefore, that several reviews of the existing fertility literature have been undertaken (Hirschman, 1994; Caldwell et al., 2003; Sobotka, 2004; Butler, 2004; Morgan & Taylor, 2006; Mills et al., 2011). These reviews have provided important insights (although sometimes focusing on specific disciplines or geographical areas), while simultaneously outlining potential directions for future research. Since the 1980s, as an increasing number of European and Asian countries reached very low fertility levels (Caldwell et al., 2003) and virtually all advanced societies witnessed a 'postponement' transition (Kohler et al., 2002). For this reason, the topic of low fertility dominated fertility research in advanced societies. During the late 2000s, a reversal of the fertility decline in most advanced countries — albeit with great heterogeneity — has drawn considerable attention (Goldstein et al., 2009; Myrskylä et al., 2009; OECD, 2011). Furthermore, the impact of economic uncertainty and the recent economic recession on fertility is another emerging topic (Mills & Blossfeld, 2005; Kreyenfeld, 2010; Sobotka et al., 2011).

The central and overarching question of this study is: What is the state of fertility research today and where is it going? To achieve this goal, our review first classifies existing studies according to the determinants of fertility. We then ask: To what extent can we make use of the determinants of fertility described in existing research to explain ongoing and expected fertility changes over time and space (i.e., cross-country and within-country heterogeneity in fertility levels)? A secondary aim is to provide an analytical synthesis of the core determinants of fertility, grouping them within the analytical level at which they operate. Determinants are positioned at the *micro-level*, including determinants at the individual and/or couple level; the *meso-level*, which encompasses social relationships and social networks (i.e., characteristics pertaining to the network of friends, co-workers, relatives and/or to the relationship that links them to the individual); at the *macro-level* of the cultural and institutional settings where individuals and couples are embedded. This article not only provides a contemporary review of research and delineation of determinants, but extends our knowledge by adopting an analytical strategy to categorize these determinants, with the aim to provide a better understanding of the often highly interdisciplinary and complex task of explaining fertility trends and differences.

We likewise extend existing reviews by adopting a broader multidisciplinary approach, which takes into account relevant contributions from different disciplines beyond those that have been examined previously (i.e., often demography and sociology). We also embrace the most contemporary advances in the field, with attention to the recent fertility reversal in advanced societies. We acknowledge that the topic is highly interdisciplinary,

with the term 'fertility' often taking on different meanings across disciplines. Subject areas are also diverse with research that examines non-human and non-animal fertility, mainly within the biological and environmental sciences. We focus only on human fertility within advanced societies, and cover research primarily within the disciplines of demography, sociology, medicine, biochemistry, genetics, molecular biology, economics and econometrics, psychology, decision and health sciences.

The present study reviews existing fertility research in a systematic and comprehensive manner, by looking at the two components that constitute human fertility: *tempo* (i.e., the timing of childbirth) and *quantum* (i.e., the total number of children). When examining *tempo,* we know that OECD countries have witnessed a rising mean age at first birth since the 1970s, coupled with an increasing proportion of births among mothers at advanced ages, albeit with considerable country-level variation (Billari et al., 2007; Sobotka et al., 2010; Mills et al., 2011). This process is generally referred to as the *postponement of childbearing*, which is the central focus of tempo studies in fertility research. The emergence of a 'postponement transition' of higher ages at first birth is a core phenomenon that has emerged in the last decades (Kohler et al., 2002; Billingsley, 2010).

Quantum is related to the number of children (including childlessness). While demographic transition theory implies that the quantum of fertility would stabilize around the replacement level of around 2.1 children per woman (e.g., Bongaarts, 2002), during the last decades of the twentieth century, advanced societies witnessed low, or even the 'lowest-low' or 'ultra-low' fertility levels close to 1 (e.g., Kohler et al, 2002; Frejka et al., 2010). The novelty of this phenomenon captivated demographers and raised the concerns of policy-makers about both the long-term demographic sustainability of their populations and concerns about the growing gap between desired and achieved fertility (Chesnais, 1996; Bongaarts, 2001; Goldstein et al., 2003; OECD, 2011). Research has demonstrated that actual childbearing levels (i.e., the number of children born by the end of the reproductive age span) have not been as low as the standard quantum measure, the total fertility rate, would suggest (Bongaarts & Feeney, 1998; Kohler et al., 2002; Sobotka, 2004). Just as there appeared to be a consensus that advanced societies would either remain at low fertility levels or reach even lower levels (e.g., Lutz et al., 2003), new research produced evidence demonstrating the start of a fertility reversal during the 2000s (Goldstein et al., 2009; Myrskylä et al., 2009; OECD, 2011).

Postponement is clearly interrelated with quantum since the age at first birth influences the (final) total number of children. Timing has always had an important influence on quantum, which is largely a measurement issue, since some of the measures that are used to study the quantum of fertility are not exclusively affected by changes in the timing of fertility. The most well-known case, for instance, is the Total Fertility Rate (TFR). Even at the micro-level there is still an influence of timing on quantum, since 'postponement' or earlier (perhaps unplanned) births are likely to affect the total number of children in some way. This is particularly relevant when studying the intended parity progression over a

certain time interval (a growing topic during the recent years). For these reasons, we will also highlight the interaction between tempo and quantum.

The remainder of this article is structured as follows. Section 2 focuses on the determinants of fertility at the micro-level, followed by Section 3, which investigates factors acting at the meso-level. Section 4 reviews fertility research at the macro-level. We conclude with a discussion that examines the current challenges and suggestions for future fertility research.

2.2 Micro-level determinants of fertility

Research at the micro-level focuses on the individual and/or couple decision-making process underlying the choice to have a child and investigates which circumstances affect decisions regarding the timing and number of children. Choices are often characterized as a rational response to uncertainty and/or as conformity to the prescribed 'sequencing' of life course events. A rich body of research has studied the link between life course circumstances and trajectories (mainly, partnership, education, employment and economic conditions) and fertility behaviour. Other research has instead focused on the role of social class and family or origin, which in turn shapes an individual's values and preferences. A major obstacle in this line of research is the challenge to establish causality, or in other words, the ability to empirically determine whether these life course factors are actual determinants of fertility or whether certain life course factors and fertility behaviour are simultaneously affected by the presence of other common determinants (endogeneity or reverse causality).

Role of intentions in the fertility decision-making process

Many scholars have used *fertility intentions* as a proximate determinant for actual fertility behavior, examining which factors influence the formation, realization and/or change in fertility intentions (e.g., Westoff & Ryder, 1977; Schoen et al., 1999; Quesnel-Vallée & Morgan, 2003; Berrington, 2004; Liefbroer, 2008; Philipov, 2009; Spéder & Kapitany, 2009; Morgan & Rackin, 2010; Iacovou & Tavares, 2011). Others have identified the systematic gap between intended and actual fertility as one of the causes of low fertility (Morgan & Taylor, 2006), since it reveals an 'unmet need' for children (Liefbroer, 2009).

Spéder & Kapitany (2009) provide a detailed overview of the rich debate on the predictive power of fertility intentions on actual behavior. Next to critical approaches that downplay the explanatory power of intentions and less individual-specific measures such as ideal family size (e.g., Westoff & Ryder 1977; Quesnel-Vallée & Morgan 2003), other studies argue that intentions are effective predictors of actual fertility (Schoen et al. 1999; Berrington, 2004). The majority of these latter studies draw upon the social psychological literature, often employing the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The TPB has been explicitly adopted, among others, by for example, Billari et al. (2009) in

a study of Bulgaria, Dommermuth et al. (2009) in Norway, as well as used to develop the questionnaires in the Generation and Gender Programme (Vikat et al., 2007). According to the TPB, intentions are the culmination of a combination of three antecedents: (i) attitudes (i.e., perceived costs and benefits); (ii) subjective norms (e.g., influence of close friends and relatives); and, (iii) perceived control over behaviour (i.e., extent to which behaviour is perceived as subject to control by the individual).

Using a different social-psychological approach, Miller & Pasta (1994; 1995) adopt the Traits-Desires-Intentions-Behavior framework (T-D-I-B), where fertility intentions are placed within a complex decision-making framework. Miller (2011) argues that having a child is the result of a sequence of motivational traits that translate into desires, which in turn form the fertility intention. That intention then translates into the behaviour of avoiding or realizing a pregnancy. An alternative model to explain human fertility is the Theory of Conjunctural Action (TCA), recently introduced by Morgan & Bachrach (2011). According to the TCA, fertility behaviour is the result of an interaction between a unique set of social circumstances (e.g., normative expectations and structural factors) and schemas, which are mental structures that the human brain uses to represent the surrounding world and to process information. This theory differs from the TPB in that it acknowledges that fertility behaviour might not only be the result of a reasoned rational deliberation, but also the result of automatic unconscious processing.

Within the existing literature, two main types of fertility intentions have been examined: 1) *quantum intentions* (i.e., intended family size); and, 2) *parity-progression intentions* (i.e., intentions to have a(nother) child at all or within a specific time frame). Quantum intentions have been shown to be a rather poor predictor of the total actual or realized number of children (Quesnel-Vallée & Morgan, 2003), as they are subject to downward or upward adjustments over the life course (Liefbroer, 2008; Iacovou & Tavares, 2011). The main factors causing variations in fertility intentions appear to be partner's expectations (Iacovou & Tavares, 2011), changes in partnership status, activity status and actual fertility events (Liefbroer, 2008). Parity-progression intentions are instead considered as more stable and reliable (Schoen et al, 1999; Philipov, 2009), despite the fact that some studies have demonstrated a mismatch between intentions and actual behaviour (Westoff & Ryder 1977; Toulemon & Testa, 2005). Specifying a time frame (e.g., two or three years) has been shown to significantly improve the predictive value of fertility intentions (Billari et al., 2009; Philipov, 2009).

Partner and Partnership

The partner's fertility intentions also play an important role in the realization of an individual's intentions, since generally childbearing in advanced societies is a joint couple decision. If there is a disagreement about childbearing expectations within the couple, the positive fertility intentions of one of the partners are less likely to be realized (Thomson, 1997; Schoen et al. 1999; Thomson, 2002;). Partnership status is also a strong predictor,

with those who are not in a stable relationship being less likely to have a child (Hobcraft & Kiernan, 1995; Philipov et al., 2006; Testa, 2006). There has also been a growth in the decoupling of first births from marriage (Buchmann & Kriesi, 2011), which is associated with an upward trend in non-marital childbearing (Dalla Zuanna, 2001, Billari & Kohler, 2004). Although the risk of having a first child has been shown to be lower in cohabiting versus marital unions (Brien et al., 1999; Baizán et al., 2003, 2004; Spedér & Kapitany, 2009), the role of cohabitation and its relationship with childbearing compared to marriage differs across countries (Heuveline & Timberlake, 2004). In France, cohabiting couples have approximately the same probability of having a child as their married counterparts (Toulemon & Testa, 2005), while in the U.S., cohabitation is associated with a lower probability of childbearing (Heaton et al., 1999). Beyond the partners' childbearing desires, a variety of other characteristics of both partners or of the couple have likewise been found to influence childbearing (e.g., Thomson et al., 1990; Corijn et al., 1996; Thomson & Hoem, 1998; Jansen & Liefbroer, 2006).

With the growth of more unstable relationships and higher levels of separation and divorce, another relevant topic has been the influence of union (in)stability and/or low relationship quality on childbearing. Although causal links are complex and there are important feedback mechanisms (Waite & Lillard, 1991), the existing literature provides evidence for two opposing mechanisms. On the one hand, some studies find a negative relationship between low quality/instability of partnership and having children (Thornton, 1978; Myers, 1997). Couples experiencing marital instability are at a lower risk of having a child due to a reduced frequency of intercourse (Cohen & Sweet, 1974; Thornton, 1977, 1978) or because they consider the fact that children might raise dissolution costs (Lillard & Waite, 1993). On the other hand, Friedman et al. (1994) argue that union instability leads to earlier childbearing since children are seen as a source of uncertainty reduction and thereby operate to enhance marital solidarity. This latter argument has also been supported by additional empirical studies (Wu, 1996; Myers, 1997). Rijken & Thomson (2011) find a non-linear relationship between relationship quality and fertility: women who experience a medium-quality relationship are the most likely to have a(nother) child, because they are the ones that are the most eager to invest in their relationship. Rijken & Liefbroer (2009) also investigate the impact of partnership quality on the timing of childbearing. Once again, two alternative mechanisms were isolated: the first is that a high-quality relationship offers a 'favourable environment' to raise children and second, that having a child may be means of 'revitalization' of one's relationship.

Gendered division of labour

Another important factor influencing fertility is the gendered division of domestic labor of couples within the household. Contemporary work builds on McDonald's (2000a, 2000b) gendered fertility theory, which argues that very low fertility is the result of a hiatus of sustained gender inequity in family-oriented social institutions. Esping-Andersen

(2009), also drawing on the work by the economist Goldin (2006), sees low fertility as a consequences of the "incompleteness" of the revolution that transformed women's roles. Empirical studies that examine gender equity at the micro-level provide interesting insights on how the gender role-set within the family affect an individual's probability to have a child. In a qualitative study of women's fertility in Canada, Matthews (1999) reports that women responded to feeling overburdened at home by having fewer children. Using U.S. data, Miller Short & Torr (2004) find a U-shaped relationship between gender equity within the couple and fertility: the probability of having a second child is higher in families with either very low or very high gender equality. Tazi-Preve (2004) demonstrates that the unequal distribution of household labour lowered men's fertility intentions in Austria. This concurs with the work of Oláh (2003), who in a comparison of Sweden and Hungary finds that a more equal gender division in household tasks accelerates the transition to the second child, noting that specific policies in Sweden supported this transition. In a study on Italy and Spain, Cooke (2009) finds that increases in employment equity between partners increased equity in the division of household labour, which had beneficial effects on the progression to a second child. The effects, however, differed across countries. In a comparative study of the Netherlands and Italy, Mills et al. (2008) find that an unequal division of household labour significantly impacts women's fertility intentions when they already have a heavy load (more work hours, children), which is particularly salient for working women in Italy. Begall & Mills (2011) also demonstrate that the degree of work-family conflict plays an important role for women across many European countries, with the prevalence of part-time work and higher perceived control over work significantly predicting the intention to become a mother.

Stepfamily fertility

The increase in unstable and multiple unions has also brought a growth in the study of *stepfamily fertility*. This body of research demonstrates that partners who already have children from previous unions are more likely to have a child together, often considered as a union commitment effect (e.g., Vikat et al. 1999; Buber & Prskawetz 2000; Stewart, 2002; Thomson et al., 2002; Prskawetz et al., 2003). Jefferies et al. (2000) for instance, find that among British women, almost half of those who experienced a marital dissolution subsequently experience a conception within twelve months, with age of the woman and age of her youngest child being the most important factors, together with repartnering. Repartnering might therefore further fuel higher fertility quantum. Given that one child is enough to indicate commitment in a partnership, multiple relationships and subsequent partnerships might significantly contribute to total fertility.

Income, education and human capital

Socio-economic circumstances of individuals have also been studied as determinants of fertility quantum and timing. Income (and wages in particular) has attracted considerable

research interest in economics. Depending on the economic model that is adopted, the effect might be different. The family economics approach, pioneered by Becker (1960), maintains that individuals obtain direct pleasure from having and raising children, and from their well-being. Children, and possibly their quality level, thus resemble a consumption good in the utility function of their parents. While the initial formulation of this theory implies a positive link between income and number of children, the large body of literature that followed focused on a *negative* relationship between income and fertility, emphasising two aspects (see Jones, Schoonbroodt & Tertilt, 2011). A first approach focuses on the *quality-quantity tradeoff*, proposed by Becker & Lewis (1973) and Willis (1973) (see also Becker, Murphy & Tamura, 1990). Here the argument is that an increase in income may lead to fewer children. This attributed to the fact that parents with a higher income value children's quality, but a focus on higher-quality raises the cost of having (and raising) children, thereby potentially reducing fertility levels. Lee & Mason (2010) apply this model to show that as income increases, lower fertility is associated with an increased expenditure in children's human capital.

A second approach focuses on the *opportunity cost* of having children, especially for women. Since raising children requires parental (and especially maternal) time, fertility is more costly for higher-income mothers, who are therefore expected to have fewer children (e.g., Kravdal, 1992). This is related to the literature that demonstrates a 'motherhood wage penalty', with postponement providing considerable earnings returns for higher educated women or those in professional occupations (Van Bavel, 2010; Begall & Mills, 2012). Miller (2010) demonstrated for example, that a year of delayed motherhood increased women's earnings by 9%, their work experience by 6% and average wage rates by 3%. Others have extended Becker's static model by setting up dynamic economic models of the optimal timing of first birth (mostly focusing on women), based on the minimization of opportunity costs of childbearing, 'wage penalty' and income loss (Happel et al., 1984; Cigno & Ermisch, 1989). They theorized and demonstrated that the higher the accumulation of human capital during education or the higher the returns to education, the later the transition to motherhood. Gustafsson (2001; 2002) demonstrated that women's career planning was the main explanation for postponement, a finding replicated in more recent studies in Sweden (Gustafsson, 2005), the U.K. (Kneale & Joshi, 2008), Ireland (O'Donoghue et al. 2010), the U.S. (Amuedo-Dorantes & Kimmel, 2005; Miller, 2010) and Italy (Rondinelli et al., 2010).

A similar approach has been adopted by the rich body literature that focuses on the relationship between education and labour market trajectories and the timing of first birth. The argument is that due to the accumulation of human capital, women with higher levels of education are more likely to pursue careers and increase their earning power. This likewise releases them from the pressure to get married and have a child for economic reasons. As the opportunity costs of childbearing and childrearing increase with human capital, highly educated women are more likely to postpone marriage and

births. An important critique of this approach has been put forth by Oppenheimer (1994), who argues that highly educated women are more likely to find partners who are highly educated as well. This in turn operates as an incentive for women (because they can further pool economic resources) to enter into a union and subsequently have children once they complete their education. In line with Oppenheimer's approach, other studies find that the higher educated are more likely to have a(nother) child or have overall, higher fertility (Mencarini & Tanturri, 2006; Mills et al., 2008), since: i) they are also likely have a partner with higher education and therefore a higher wage (Behrman & Rosenzweig, 2002); ii) they have stronger bargaining power within the couple, leading to a more equal division of domestic labour; and, iii) they can outsource housework. Although higher educated women have their first child later than their lower educated counterparts, some studies (Sobotka, 2004; Kravdal & Rindfuss, 2008) have highlighted that the higher educated are also more likely to recuperate at a later age. Or in other words, that the cumulative impact of late motherhood on higher-order birth rates (i.e., second or third births) disappears.

The results linking education to fertility are, however, mixed, with recent empirical results instead showing a non-relevant association between education and fertility (e.g., Skirbekk, 2008). Using a natural experiment approach on school entry policies in California and Texas (which should be able to unravel causality), McCrary & Royer (2011) find that education does not significantly impact fertility. Several studies also find a strong inverse relationship between educational attainment and the timing of first births in different countries (Rindfuss, Bumpass & St. John, 1980; Rindfuss, Morgan & Offutt, 1996; Martin, 2000 for the U.S.; Joshi, 2002 for U.K.; Lappegard, 2002 for Norway; Meron & Widmer, 2002 for France; Noguera, Golsch & Steinhage, 2003 for Spain).

Other researchers have instead focused on the importance of educational enrolment, as opposed to the highest achieved level of education. Here findings show that individuals who are still enrolled in education are at a lower risk of having a child, likely attributed to the presence of a 'sequencing norm' of first finishing education, followed by parenthood (Hoem, 1986 for Sweden; Goldscheider & Waite, 1986 for the U.S.; Blossfeld & Huinink, 1991 for Germany; Kravdal, 1994, for Norway). Others have extended this research to also examine the importance of the educational field of study in relation to either socialization or self-selection effects into later occupations, which in turn impact fertility (e.g., Hoem, Neyer & Andersson 2006; van Bavel, 2010; Begall & Mills, 2012). Almost all studies focus exclusively on women, with some noticeable exceptions. Winkler-Dworak & Toulemon (2007), for instance, explicitly study the convergence in explanatory factors explaining the age at first birth for women and men.

Economic and employment uncertainty

Further, mostly sociological studies, focus on the importance of employment status and particularly economic uncertainty on fertility outcomes. Theories of (largely economic) uncertainty are reminiscent of Easterlin's (1976) theory of economic deprivation,

which posits that in historical periods of general economic uncertainty and rising unemployment, the tendency to marry and have children appears to diminish. This also relates to Oppenheimer's (1988; 2003; Oppenheimer et al. 1997) work on the impact of uncertainty in social and economic roles on the timing of family transitions. An increasing number of studies link economic uncertainty – often in the form of unemployment and precarious labour market situations – to the postponement of parenthood. In order to empirically measure the impact of uncertainty on the entry into parenthood in a cross-national context, Mills & Blossfeld (2005) developed a schema consisting of three types of uncertainty: economic, temporal, and employment relation. They found that under conditions of economic uncertainty, which is the caliber of economic precariousness of an individuals' employment circumstances (e.g., lower earnings, unemployment), youth deferred long-term binding commitments such as parenthood that require a secure economic basis (Oppenheimer, 1988) or what Rindfuss & Vandenheuvel (1990) refer to as the 'affordability clause' to have a child. Following Breen (1997), temporal uncertainty (i.e., often in the form of temporary or fixed-term contracts) reduced youth's ability to make long-term commitments such as parenthood. Finally, lower employment relationship uncertainty (e.g., dependent workers versus self-employed or contract workers) were impeded by their more precarious positions. The impact of uncertainty, however, was highly filtered by national-level institutions, such as the amount of protection young adults received from the welfare state to shelter them from uncertainty, and gender systems, which resulted in differential responses to uncertainty of women across different national contexts (Mills, Blossfeld & Klijzing, 2005).

Kreyenfeld (2010) finds that both objective economic uncertainty (unemployment) and subjective uncertainty (fear of economic situation and job security) have little impact on the postponement of parenthood, with the level of education operating as the underlying driver of the process. In other words, lower educated mothers respond to economic uncertainty by adopting the role of mothers, while their highly educated counterparts postpone childbearing.

Fertility preferences

An individual's fertility decisions are shaped by his or her own *preferences*, which several authors emphasise, are shaped early in an individual's life. Catherine Hakim's *Preference Theory* (2003) positions the heterogeneity of women's lifestyle preferences at the heart of fertility (and labour market) choices in advanced societies. Hakim assumes that lifestyle preferences are rather constant across the life course, with three main types: career-oriented, family-oriented and those oriented towards combining work and family. These lifestyle preferences are seen as the main driver, with policies required that take into account this heterogeneity. In a comparative study within Europe, Vitali et al. (2009) find that family-oriented women are the most fertile, whereas work-oriented women usually have fewer children or even no children at all (albeit the causal direction remains unclear).

Other studies (Mencarini & Tanturri, 2006; Agrillo & Nelini, 2008) find that, among other factors, preferences play a crucial role in the decision to remain voluntarily childless or 'child-free'. While Agrillo & Nelini (2008) provide a detailed overview of the psychological and sociological factors associated with voluntary childlessness, medical research often focuses on physical causes related to infertility.

Research on preferences for the sex composition of children shows an effect of sex preferences on the probability to have more children, albeit with considerable variation across countries (Hank & Kohler, 2000). Andersson et al. (2006) and Mills & Begall (2010), for instance, find the presence of a mixed-sex preference (i.e., preference to have at least one boy and one girl), which prompts a significantly higher likelihood to the progression to the third child to reach this goal.

Intergenerational transmission of values and behaviour

The *similarities of fertility histories across successive generations* has also been a core area of research, focusing mainly on the stable result of a positive correlation between the number of siblings and number of own children (e.g., Berent, 1953; Duncan et al., 1965; Johnson & Stokes, 1976; Zimmer & Fulton, 1980; Thornton, 1980; Anderton et al., 1987; Axinn et al., 1994; Murphy & Wang, 2001) or between the age at first birth of parents and that of their children (Rijken & Liefbroer, 2009). The majority of studies concerning tempo focus on teenage motherhood, demonstrating that having had a young mother increases the risk of having a child at a young age (Furstenberg, Levine, & Brooks-Gunn, 1990; Horwitz et al., 1991; Kahn & Anderson, 1992; Manlove, 1997). Barber (2000; 2001) and Steenhof & Liefbroer (2008) also find corresponding results for later ages and for men. Within this body of literature, the intergenerational transmission of behaviour is considered to be driven by intra-familial socialisation processes that occur during childhood and adolescence (Hendershot, 1969; Thornton, 1980; Axinn, Clarkberg & Thornton, 1994; Murphy & Wang, 2001). The assumption is that parents transmit family values, preferences and attitudes, as well as contraceptive knowledge. Rijken & Liefbroer (2009), however, show that this effect is fully mediated by the child's own degree of religiosity. Intergenerationally transmitted knowledge, attitudes and values can be seen as individual characteristics that have a long-term effect in the same way that genetic heritage is transmitted from parents to children.

Biodemography of fertility

Next to socialisation mechanisms, biological and genetic factors have also been used to explain intergenerational similarities in fertility preferences and behaviour (Wachter & Bulatao 2003). A series of studies have linked biological and genetic components to fertility behaviour (Kohler et al. 1999; 2002; Kohler & Rodgers 2003; Rodgers et al. 2008). This body of research focuses on studying the interplay between fertility, environment and genetic make-up of individuals and demonstrates that differences in the genetic

composition of individuals affect their fertility outcomes and fertility related behaviour. They often adopt a 'twin design' which compares monozygotic twins (with virtually identical genetic makeup) with dizygotic twins. This permits the separation of what proportion of the variance is attributed to genetic, shared-environment (i.e., growing up in the same household, environment) or non-shared environment (i.e., all other factors such having different partners). Kohler et al. (1999), for example, used Danish twin data to disentangle genetic and social influences on the patterns of heritability for the number of children, finding that genetic influences appeared to largely override previous shared social (familial) environments for younger cohorts.

These types of studies are part of the emerging field of the biodemography of fertility, which is an interdisciplinary area of fertility research that combines theories from the social sciences (sociology, economics) with approaches from behavioural and molecular genetics, neuro-endrocrinology and evolutionary theory (Wachter & Bulatao 2003). The central premise is that genetic and biological dispositions of individuals influence fertility either directly via genetically mediated variations or, since many aspects regulating fertility possess considerable volitional control (e.g., decision of age at first birth, fertility preferences), via underlying temperament or personality influences on fertility decisions (Jokela et al., 2009). There is also growing evidence that genetic variance changes over time and across educational levels, meaning that the importance of social norms and individual decision-making change across time (Kohler et al., 1999; 2002; Kohler & Rodgers, 2003). The biology of fertility has also been revolutionized by the rapid diffusion of various types of assisted reproductive technologies (ART). ART not only provides new opportunities to extend the reproductive window for couples who desire to have children at a later age, but also enables parenthood for many couples that would have previously been considered sterile, with ART utilization increasing rapidly across Europe (de Mouzon et al., 2010).

Socioeconomic status and cultural context of family of origin

A related stream of research investigates the effect of the socio-economic and cultural context of the family of origin on an individual's age at childbearing and fertility quantum decisions. Some studies have shown that there is a negative relationship between parents' educational level (especially father's education) and age at first birth (Michael & Tuma, 1985; Blossfeld & Huinink, 1991; Billari 2001a; 2001b;) as well as the number of children (Murphy & Wang, 2001; Rijken & Liefbroer, 2009). A negative relationship has also been found between parents' financial situation (i.e., job status) and (expected) number of children (Thornton, 1980, Murphy & Wang, 2001) and age at first birth (Rijken & Liefbroer, 2009). These findings suggest that in higher educated and high-status families, other goals beyond family formation are more easily transmitted, together with aspirations for material goods (Easterlin, 1969; Pampel & Peters, 1995). Therefore, if consumption aspirations are high, parenthood will be reduced or at least postponed. This is in line with findings that show a negative effect of employed mothers (compared to non-employed ones) on the age

of first birth of their offspring (Barber, 2000). For the opposite reason, parents' religiosity is positively associated with their children's fertility (Rijken & Liefbroer, 2009).

Reverse causality at the micro-level

Several articles have explicitly attempted to uncover causality in the relationship between partnership and childbearing. Using simultaneous hazard models on U.S. data, Brien et al. (1999) show that common factors exist, with being in a partnership resulting in a higher likelihood of childbearing. The comparison between cohabitation and marriage, with similar approaches based on simultaneous hazard equations, is the focus of Baizán et al. (2003 for Spain; 2004 for Sweden and Germany), Le Goff (2002) for France and West Germany, Steele et al. (2005, 2006) and Aassve et al. (2007) for Britain. Spéder & Kapitany (2009), instead, use time-dependent fertility intentions (i.e., intention to have a child within 3 years) and look at the realization of these intentions to investigate which micro-level factors are associated with a higher probability of postponing the realization of childbearing intention beyond the planned time span.

Just as the relationship between partnership and fertility, the relationship between education and the timing of childbearing can be spurious (i.e., affected by common observed or unobserved factors), reversed, or the result of an individual's simultaneous choice in the two life spheres. Therefore, in order to properly estimate the effect of education (or job career, or education field) on the age at first birth, potential endogeneity issues must be taken into account (Billari & Philipov, 2004).

Another topic where causality is a key challenge is studying the relationship between childbearing and well-being. A limited, but growing body of research has highlighted the role of happiness as a determinant of fertility, with consistent results for both sexes. Using the European Social Survey, Billari (2009) demonstrates that happier people are more likely to intend to have a(nother) child, while using longitudinal data from Australia, Parr (2010), finds that life satisfaction is a determinant of fertility.

More attention has been devoted to investigating the opposite direction of the relationship between childbearing and well-being. While older studies seem to imply that in advanced societies children were detrimental to marital well-being (see the review of McLanahan & Adams, 1987), more recent research connect childbearing decisions with well-being, in various other ways. The 'value of children' theory (Hoffman & Hoffman, 1973; Hoffman & Manis, 1979; Friedman et al., 1994), recently reconceptualised as a special case of the general theory of social production functions (see, e.g., Nauck, 2007), envisions having children as instrumental in maximising individual utility as expressed by the combination of physical well-being and social esteem. In this sense, having children when fertility control is available positively contributes to individual well-being. Building on this approach, Kohler et al. (2005) demonstrate that becoming a parent contributes positively to parents' *happiness*. Using Danish twin data and a rigorous econometric

approach that accounts for possible sources of endogeneity (e.g., genetic factors), the authors find a non-linear effect of children on happiness, especially for women. Women's happiness increases after the first child, but having higher-order children is not associated with further increases in well-being. In Europe, parents have been found to be generally happier than non-parents (Aassve, Goisis & Sironi, 2011). Examining the dynamic relationship between having children and happiness, Pouwels (2011) finds an inverse U-shaped effect of first birth, by showing that in the year before and after the first childbirth, parents experience a sharp increase in the level of happiness. Happiness, however, appears to drop some months after the delivery and new parents are found to be unhappier than previously for a considerable period. Margolis & Myrskylä (2011) also investigate the age- and context-specificity of the relationship between happiness and childbearing.

Finally, another emerging body of research where reverse causality is relevant is the link between the field of education and age at first birth (Lappegård 2002; Lappegård & Rønsen 2005 for Norway; Martín-García & Baizán 2006 for Spain; Neyer & Hoem 2008 for Austria; McDonald & Kippen, 2009 for Australia; Van Bavel, 2010, several countries; Begall & Mills, 2012 for the Netherlands). These studies show earlier fertility among women in educational fields related to the more 'feminine' fields of caring (e.g., teaching, health), although there are no clear causal relationships. The mechanism is that women either self-select themselves into educational paths that lead to jobs where they are more able to combine motherhood and employment or, the difficulty of combing career and children varies by chosen career type.

2.3 Meso-level determinants of fertility

In recent years, increasing attention has been devoted to developing and applying theories that take into account the fact that individuals are positioned as social actors who make decisions and act while embedded in a web of social relationships with kin and peers. While some studies focus on the role of interpersonal interactions in shaping an individual's fertility decision-making, others investigate how the place of residence is associated with reproductive choices. Finally, another body of research looks at the social network as a source of social capital in the form of emotional and material aid. The acknowledgement of the importance of the social network in explaining observed fertility patterns has not as of yet, however, been coupled with a convincing body of empirical research. The central reason rests with the lack of suitable data and the difficulty to model and properly identify social interaction effects and disentangle them from selection and contextual factors.

Social interaction

The impact of social interaction on fertility choices has received considerable attention (e.g., Bongaarts & Watkins 1996; Entwisle et al. 1996; Montgomery & Casterline, 1996; Kohler 1997, 2001; Bernardi, 2003). This literature has

predominately focused on the diffusion of contraceptive methods in developing countries (Kohler et al., 2001) and identified two channels via which social interaction takes place. The first is *social learning,* or how individuals gain knowledge from others, and the second is *social influence*, which is how consensus in peer groups constrains attitudes and behaviour (Montgomery & Casterline, 1996; Kohler et al., 2001).

In advanced societies, the evidence largely comes from small-scale qualitative studies, which illustrate that personal network contacts such as co-workers or friends are pivotal in shaping both fertility timing as well as quantum decisions (Bernardi 2003; Bernardi, Keim & von der Lippe, 2007; Keim, Klarner & Bernardi, 2009; Rossier & Bernardi, 2009; Bernardi & White, 2009). Individuals look to co-workers, for example, as a key source of social learning, to see how and whether they successfully navigate the combination of having children with a career.

Rigorous quantitative studies, however, are still lacking. To our knowledge, only a handful of studies have adopted a quantitative approach. Axinn et al. (1994) showed that the higher the number of nephews and nieces, the higher the preferred number of children. Manski & Mayshar (2003) interpret the peculiarity of Israeli's fertility transition in light of social interactions. Billari et al. (2009), integrating a network-based approach into the Theory of Planned Behavior, find that social pressure from relevant others significantly influences women's intention to have a child. Balbo & Mills (2011) consistently find that social pressure from kin and friends to have another child is associated with positive fertility intentions to have a second or third child. Turning to the timing of childbearing, the few quantitative studies that investigate the impact of social interaction demonstrate that when a sibling (Kuziemko, 2006; Lyngstad & Prskawetz, 2010) or a co-worker (Hensvik & Nilsson, 2010) have a child, the risk for the individual to have a child also increases. These studies have adopted event history analysis techniques that uncover a short-term, U-shaped effect, with the contagion effect very strong and increasing in the 12th (Lyngstad & Prskawetz, 2010) or 24th month (Kuziemko, 2006; Hensvik & Nilsson, 2010) after the relevant other's childbearing. It then declines, becoming negligible in the long run.

An innovative approach is the one adopted by Aparicio Diaz et al. (2011), who apply an agent-based simulation model to study the effect of social interactions on the transition to parenthood in Austria during the period 1984-2004. Their simulations showed that social interdependencies among individuals can explain the substantial shift of first birth to a later age that occurred in Austria in the past decades.

Place of residence

Several studies document fertility differences by place of residence along several lines. First, fertility continues to vary across regions (Hank, 2001, 2002; Caltabiano, 2008; Kertzer et al., 2009). According to Kulu (2011), differences in desired family size explain fertility

differentials between small towns and rural areas on the one hand, and urban areas on the other. Second, within urban areas, suburbs are consistently found to have higher fertility (Kulu, Boyle & Andersson, 2009), with single-family households associated with higher fertility (Kulu & Vikat, 2007). These differentials persist when controlling for the socio-economic composition of areas (Kulu & Boyle, 2009), suggesting that contextual effects shape fertility decisions. It is interesting to note that differences in urban and rural fertility quantum persist over time (Kulu et al., 2009), whereas differences in fertility timing have only recently emerged. As a result, postponement has been more pronounced in larger rather than in smaller settlements

Social capital

The body of research focussing on the social network as a source of *social capital* (Bühler & Philipov, 2005; Philipov et al., 2006) stems largely from sociological theory (Lin et al,. 2001; Flap & Völker, 2004; Mandemakers & Dykstra, 2008). Social capital is defined as the resources that individuals have access to via personal relationships and can include goods, as well as information, money, capacity to work, influence, power or active help (Granovetter, 1973; Bourdieu, 1986; Coleman, 1988). Building on previous sociological applications (Granovetter, 1973; Bourdieu, 1986; Lin et al,. 2001; Flap & Völker, 2004), some demographic studies have demonstrated how social capital (or the lack thereof), next to economic and cultural resources, shapes fertility decision-making (e.g., Schoen et al., 1997, Astone et al., 1999; Bühler & Philipov, 2005; Philipov et al., 2006). This research looks at long-term, stable and trusting relationships (e.g., family members, grandparents, close friends or relatives) that can provide the individual or the couple with fertility-relevant supportive resources. Therefore, although the exchange of these resources occurs only *ad hoc,* that is, whenever they are needed (e.g., use of informal childcare when children are young), the set of relationships from which they are drawn is likely to be stable over the life course.

The majority of existing studies on social capital as a determinant of (low) fertility has focused on ex-communist Eastern European countries. This region has undergone a period of extreme socio-economic uncertainty after the end of the Soviet Union. Bühler & Philipov (2005) provide an extensive theoretical discussion of how social capital is related to social networks and how it affects the formation of fertility intentions. They also show that, in such a context, supportive network relationships and resources play a crucial role in an individual's fertility decision-making. Consistent with this argument, other empirical studies demonstrate that the greater the social capital, the higher the probability to have (or want) a(nother) child (Philipov 2002 for Russia; Philipov et al. 2006 for Bulgaria and Hungary; Bühler & Fratzcak 2007 for Poland) and to have the child sooner (Bühler & Philipov, 2005; Philipov et al., 2006).

Bühler & Fratzcak (2007) find a positive effect of social capital on fertility, with this influence being highly parity-specific and particularly strong for second births. As far as

Western European countries are concerned, Hank & Kreyenfeld (2003) find that in West Germany, access to informal care arrangements (i.e., care provided by grandparents) increases the risk of first birth. Balbo & Mills (2011) show a non-linear relationship (i.e., inverse U-shaped) between informal childcare and the probability for German men of wanting a second or third child. Receiving no support at all and receiving support from too many sources (i.e., several different people) are both associated with a lower probability of intending to have another child, with the latter likely related to coordination problems.

The U.S. literature focuses on the support that kin provide to mothers, including childcare and help with raising children, especially for single mothers — here kin are seen as providing 'safety nets'. This is particularly significant given the high rates of partnership instability and single parenthood (Swartz, 2009) and is a strong focus of the 'Fragile Families' study (Harknett et al., 2001). Harknett & Knab (2007) find that multipartnered fertility, through the difficulties of maintaining kin networks, lowers the financial, housing and child-care support to mothers. Harknett & Sten Hartnett (2011) likewise find that support from kin and friends are more often available to mothers who can reciprocate, and families with more difficulties have lower support.

Confounding factors and reverse causality at the meso-level

The acknowledgement of the importance of social interaction in explaining observed fertility patterns has not yet, however, been coupled with a convincing body of empirical research. The central reason rests with the lack of suitable data and the difficulty to model and properly identify social interaction effects (Manski, 1993; 1995). The social context or other individual-level factors common among individuals can also explain similarities in behaviour (e.g., same timing of childbearing) (Christakis & Fowler, 2007; Cohen-Cole & Fletcher, 2008; Bramoullè et al., 2009; Steglich et al., 2010; Fletcher, 2011), and the social network may be chosen according to desired behaviours and changes over time.

Finally, it is essential to note that the association between the place of residence and fertility choices raises causality concerns, since the relation might be spurious and the effect can work in both directions.

2.4 Macro-level determinants of fertility

A vast literature focuses on how the cultural and institutional setting in which individuals and couples are embedded affects their fertility decision-making. Here an 'economy versus culture' dichotomy can be identified (Billari, 2004). Whereas several studies investigate how economic trends, social policies, institutional constraints and welfare regimes influence fertility tempo and quantum, other contributions focus on the influence of values, attitudes and culture in reproductive behaviour. Moreover, next to these two broad approaches, other macro-level studies look at the role of contraceptive technologies

in fertility dynamics. Once again, the main challenge of this literature rests on how to deal with endogeneity and causality issues, which are elaborated upon at the end of this section.

Economic trends

Period effects of economic trends on fertility are usually investigated by linking the Total Fertility Rate (TFR) to macroeconomic indicators (e.g., GDP and unemployment rate). As mentioned in the introduction, despite the fact that the influence of the timing of fertility on the TFR is mainly a measure of fertility quantum, it does incorporate timing aspects as well**.** The relationship between TFR and GDP is ambiguous, as Sobotka et al. (2011) demonstrated. Using data from 26 OECD countries for the period 1971–2008, they report a weak correlation between changes in GDP and period TFR, arguing that this might be a result of cross-country differences. Several studies find a pro-cyclical relationship between economic growth and fertility in the developed world. Martin (2004), for example, finds that a higher GDP is associated with higher fertility in Australia. Fertility decline during economic recessions are seen as a result of childbearing postponement, especially of first births, which can later be largely compensated during times of economic prosperity (Neels, 2010). Similar arguments can be found in Kohler et al. (2002), Mills & Blossfeld (2005) and Sobotka et al. (2010), who maintain that an economic downturn brings about uncertainties that in turn, lead to postponement. Some empirical studies also support this hypothesis. Santow & Bracher (2001) find a negative effect of the GDP decline on first birth rates in Sweden. Sobotka et al. (2011) show that the recent economic crisis that occurred in 2008-2009 in Europe and the U.S. seems to be associated with a decline in fertility, likely due to postponement effects.

Other studies, however, find contrasting results. Butz & Ward (1979) suggest that economic upswings bring about the increased employment of women, making children more expensive during times of economic prosperity. Therefore fertility trends are likely to be counter-cyclical. Macunovich (1996) finds evidence for this expectation in the U.S.. The negative relationship between economic growth and postponement also seems to be contradicted by some recent studies. Billingsley (2010) finds that the GDP in Eastern Europe after 1990 is positively correlated with fertility postponement, a result also observed in Hungary for the timing of first birth (Aassve, Billari & Spéder, 2006). These latter studies are examples of a broader literature that adopts the economic crisis argument to explain the sharp decline in fertility that Central and Eastern European countries have undergone after the fall of communism. Once again, however, the evidence is mixed. Kohler & Kohler (2002), using Russian data, find, for instance, a negative association between a drop in GDP and TFR at the macro-level, but this finding is not observed at the micro-level.

A related approach that has recently received great attention is the one that explains fertility patterns and cross-country fertility differences in terms of socio-economic

development. Myrskylä, Kohler & Billari (2009) provide evidence for a fundamental change in the well-established negative relationship between fertility and development (Bryant, 2007). They find that while low and medium levels of the Human Development Index (HDI) are associated with persistent low fertility, higher HDI levels seem to promote fertility, reversing the declining pattern.

Instead of looking at GDP, other researchers maintain that indicators of consumer confidence are a better measure of economic recessions, because they reflect the subjective perception of crisis. Van Giersbergen & de Beer (1997) and Fokkema et al. (2008) find a positive relationship between this indicator and TFR in The Netherlands.

(Un)employment trends

Economic uncertainty has also been studied by examining the effects of *unemployment* trends on the TFR. Findings consistently showed a negative association: the higher the unemployment, the lower the quantum of fertility (Macunovich, 1996; Adserà, 2004, Örsal & Goldstein, 2010) or the higher the postponement, which was found for first and second births (Adserà, 2010; 2011).

Adopting a complementary approach, other studies focus on the relationship between female labour force participation (LFP) and TFR, showing that in OECD countries, this association has changed from negative (where countries with higher LFP had lower TFR) to positive during the 1980s. Benjamin (2001), Pampel (2001), Ahn & Mira (2002), and Kögel (2004) provide some theoretical explanations and empirical evidence to describe the change in this cross-country correlation. It is, however, challenging to assess whether this implies a change in the causal relationship between the two variables. Mishra et al. (2010), engaging in a macro-econometric analysis aimed at ruling out endogeneity in order to unravel causation, find that causality runs from changes in fertility (TFR) to changes in labour force participation (LFP).

Another approach on the effects of economic trends has been developed by Easterlin (1961; 1968). According to Easterlin, cyclical changes in fertility are mainly due to fluctuations in birth rates and cohort size. Members of larger cohorts face more competition and thereby reduced economic opportunities, leading to lower fertility (for further details, see review of Pampel & Peters, 1995).

Policy measures

A second stream of research has studied the impact of policy measures (e.g., labour-market, fiscal, family, or housing policies) on the timing of parenthood, as well as on fertility quantum. There is mixed evidence regarding the effectiveness of social policies on fertility (Neyer, 2003, Gauthier, 2007, Hoem, 2008; Mills et al., 2011). Gauthier (2007) argues that their effects, although small, seem to affect the timing of fertility rather than the number of children.

A large number of studies investigate the effects of childcare provision on fertility. Most of the empirical research shows mixed findings. While some studies find that regions with poor childcare coverage have higher fertility (e.g., Kravdal, 1996; Rosen, 2004), others, arguing that they take endogeneity into account, find that public availability of childcare has a positive effect on fertility (Del Boca, 2002; Rindfuss et al., 2010). Manuelli & Seshadri (2009) present a model and empirical analyses in which higher tax rates determine low fertility. Social security systems, and the reform in social security, have been discussed as determinants of fertility (Cigno & Rosati, 1992). The relevance of social security for fertility choices is also linked to the idea that children may provide security in old age, also in advanced societies (Rendall & Bahchieva, 1998; Mills & Begall 2010). Galasso, Gatti & Profeta (2009), for instance, show that the generosity of public pensions is negatively associated with fertility.

Similar to economic factors, with which they are closely interrelated (Hoem & Hoem, 1997), the effect of family policies varies according to the institutional context and individual-level determinants. For this reason, there has been only minor attention to pure macro analyses, focussing on time-series variation within a country. This includes an article by Ermisch (1999), who finds that generous child allowances in Britain encourage young motherhood and Hoem (2005) and Andersson et al. (2006), who show that parental-leave allowance reduces postponement in Sweden. The majority of research on policy measures and timing of childbearing consists of either micro-level (individual or couple) studies, where the policy variable is one of the independent variables, or cross-national studies (sometimes multilevel) involving nations with differing policies. Although each approach has its drawbacks (for a detailed discussion see Neyer & Andersson, 2008), the latter two methods permit the examination of interactions between analytical levels.

Welfare regimes

Building on the work of Esping-Andersen (1990; 1999), numerous scholars have explained cross-country differences in fertility and life course patterns by linking them to different institutional constellations (e.g., Mills & Blossfeld, 2005; see also Neyer 2003 for a feminist critique). As described in Mills & Blossfeld (2005), who link different welfare-regimes to fertility postponement, differences between welfare regimes manifest themselves in the priority of: (1) active employment-sustaining labour market policies (i.e., the commitment to full employment); (2) welfare-sustaining employment exit policies (i.e., support for those who are outside of the labour market such as youth, unemployed, ill, poor, family care workers, pensioners); (3) the scope and generosity of family allowances and services (i.e., maternity/paternity leave, childcare); and, (4) the share of the public sector in the labour force. This constellation of policies in turn impacts the safety net that individuals can draw upon if they are unemployed, employment regulations and family-related services (childcare, leave), which in turn enable or constrain decision-making about entry into parenthood or having additional children.

Defamilialized regimes, where the households' welfare and caring responsibilities are largely supported by the welfare state (and not the family), such as Nordic socio-democratic countries, or market provision (Anglo-Saxon liberal market regimes), enable higher fertility. Conversely, familistic states (Conservative and especially Southern European regimes), where the majority of the economic and caring responsibilities rest on the family, where institutions also support a traditional division of the domestic labour (i.e., the so-called male-breadwinner model; Blossfeld & Drobnič 2001), constrain fertility, resulting in lower fertility levels.

This literature is mainly developed at the theoretical level. Researchers focus on the different manifestations of lack of state support, describing how these factors make it difficult to combine work and family, especially for women, forcing them to choose between a career versus motherhood, thereby resulting in postponing or forgoing of children (e.g., Castels & Ferrera, 1996; Mayer, 2004). The direct empirical research linking specific welfare regimes explicitly to fertility is limited due to the high complexity of modelling these regimes and, similar to research on social policies and fertility, it consists of either analyses at the micro-level where the effect of the different welfare regimes is measured by simple dummy variables, or cross-national studies (sometimes multilevel) involving countries with different institutional arrangements. Examples of this empirical body of research are reviewed in the final section of this paper (Section 5), where the interaction between micro- and macro-level is discussed.

Value and attitude changes

This stream of research largely stems from the 'Second Demographic Transition' (SDT), developed by Lesthaeghe & van de Kaa (1986) to interpret demographic changes in industrialized societies. According to this theory, ideational changes, that mainly consist of the rejection of institutional control, accentuation of individual autonomy and the rise of self-realization needs (Surkyn & Lesthaeghe, 2004), are the driving forces of new family arrangements and behaviours, among which fertility postponement, reduced number of children, or childlessness, that have developed since the 1960s. The SDT framework has been used as an alternative (Lesthaeghe, 1983 for Belgium) or complementary explanation (Billingsley, 2010 for Eastern European countries), next to economic cycle effects, to fertility quantum variations. Lesthaeghe (2010, p.242), one of the proponents of this theory, has however underlined that "*the SDT theory fully recognizes the effects of macro-level structural changes and of micro-level economic calculus. But… the SDT theory does not consider cultural change as endogenous to any economic model, but as a necessary additional force with its own exogenous effects on demographic outcomes*".

As highlighted by van de Kaa (1997), such ideational changes may occur in different periods and at a different intensity across diverse areas. Some articles provide support for the SDT, showing a delay of fertility in relation to increased autonomy and independence, such as Liefbroer (2005) for the Netherlands and Bernhardt & Goldscheider (2006) for

Sweden. An interesting approach is the developmental idealism framework elaborated by Thornton & Philipov (2009), according to which ideational influences and the intersection of these ideational influences with structural factors are the main forces driving the fertility decline in Central and Eastern Europe after the end of the Soviet Union.

Other studies focus on the impact of changing social norms on fertility. Several researchers have documented the relevance of *age deadlines* for childbearing (i.e., ages after which it is not socially acceptable to become a parent) (Settersten & Hagestad, 1996; Liefbroer & Billari, 2010). Billari et al. (2011) illustrate that age deadlines are positively associated with the prevalence of ART in a given country.

Similar to the welfare-regime research, this literature is also mainly theoretical. This is primarily attributed to the difficulties in collecting data on ideational changes at the societal level. To overcome this issue, some studies (e.g., Liefbroer, 2005; Bernhardt & Goldscheider, 2006) empirically operationalize changes in values and norms using micro-level individual measurements, although they assume the value changes to occur at the societal level.

Historical and cultural continuities

Some studies identify historical and cultural continuities – or path dependency – as the roots of present fertility behaviours, reaching similar conclusions to that of Esping-Andersen (Reher, 1998; Micheli, 2000; Dalla Zuanna, 2001). However, this literature, by strongly emphasizing the importance of cultural background, assumes that culture has shaped institutional settings (Pfau-Effinger, 1999).

This body of research can be distinguished along *East-West and North-South divides* (see Billari, 2004 for a more detailed overview). The East-West divide in Europe, running along an imaginary line connecting Trieste and St. Petersburg, was first noticed by Hajnal (1965). On the West side of the 'Hajnal line,' areas were characterized by late and not universal marriage, whereas to the East of the line, marriage was early and widespread. Historical continuities are then assumed to explain why birth happen earlier to the East of the Hajnal line. The North-South divide, first elaborated by Reher (1998), considers the strength of intergenerational family ties: while Southern countries are characterized by strong family ties, Northern areas generally have weak family ties. The main argument is that systems characterized by strong kinship and intergenerational relationship (e.g., Southern European familistic countries) are those where couples have lower fertility (Dalla Zuanna, 2001; Livi-Bacci, 2001) and young people delay the transition to adulthood, in turn implying a postponement of childbearing (Billari, 2004). It is essential to note that familistic regimes, both from an institutional as well as cultural point of view, are not 'per se' detrimental to fertility. It is rather the interaction of these systems with the recent increased female status in the educational and labour market system and lack of

institutional support to combine work and family that is the root cause of low fertility (Feyrer et al., 2008; Mills et al. 2008).

Studies on immigrants, linking fertility in the place of origin to the behaviour of individuals in a 'destination' country have also shown the relevance of cultural continuities (Fernández & Fogli, 2006; 2009), with continuity in behaviour. Nevertheless, migrants often show behaviour that converges to their place of destination, demonstrating that adaptation prevails on selectivity (Kulu, 2005).

Contraceptive and reproductive technologies

Fertility differentials at the macro-level are not only explained by 'economy' and 'culture'. Researchers have widely studied the crucial role of the '*contraceptive revolution*' on fertility quantum (e.g., Frejka, 2008) and fertility postponement (for a detailed review see Sobotka, 2004). The spread of modern contraception, and especially the pill, has radically changed the nature of the fertility-decision making and contributed to the reduction in the number of children and the postponement of childbearing (Goldin, 2006). Murphy (1993) argues that short-term changes in fertility in England and Wales during the 1970s and the early 1980s can be better explained by the swings in *contraceptive pill use*, due to fears of the pill's side effects. Bailey (2010) exploits variation in laws permitting the sales of contraceptives in U.S. states as a natural experiment to show that contraception causally contributed to the reduction of period fertility rates. Sobotka et al. (2010) assesses the importance of ART (Assisted Reproductive Technology) on fertility using data from Denmark. They project a rising share of children born as a result of ART, with a 5% contribution to the TFR of the 1975 birth cohort. Moreover, the development ART seems to challenge the biological limits to postponement (Billari et al., 2007; see Leridon, 2008 for an analysis of the extent to which ART affects the probability of becoming a parent at advanced ages).

Endogeneity of policies and reverse causality at the macro-level

Difficulties in disentangling the impact of policies from other observable or unobservable factors have often frustrated the effort to uncover policy effects on fertility. It is difficult to separate the impact of any specific policy from the broad range of policy instruments that potentially influence fertility and it is problematic to empirically establish whether a specific policy was successful due to the temporal lag between policy initiation and take-up. Finally, there is the problem of endogeneity of policies, in that they may not only impact fertility and induce change, but are often a reaction to changes in fertility and an integral feature of these changes. A rigorous analysis conducted by Kalwij (2010), however, finds a positive effect on fertility quantum due to an increased expenditure for family policy programs that help women to combine family and employment, thereby reducing the opportunity cost of children. Fiscal policies, that more easily allow implementing quasi-experimental strategies, have attracted the attention of many economists. Positive effects of fiscal incentives on fertility quantum have been found in Germany (Buttern & Lutz,

1990), Sweden (Walker, 1995), Canada (Milligan, 2005), and the U.S. (Whittington, 1993). Gauthier & Hatzius (1997) found more mixed results in employing a cross-country panel.

2.5 Discussion

Our review demonstrates that research on fertility in advanced societies is not only extensive, but continues to thrive and evolve in innovative ways. The central goal of this paper was to evaluate the current state of fertility research in order to classify and assess different approaches and the knowledge they have added. A secondary goal was to classify existing research according to the three analytical levels of macro-, meso- and micro-level approaches and findings. We likewise placed considerable attention to causality and endogeneity issues.

We first demonstrated that there have been considerable advances on several fronts in the study of micro-level determinants. In addition to the consideration of key determinants, such as employment, income, and education (and nuances within these areas), promising new and innovative research has focused on how the gendered division of labour, family composition (e.g., stepfamilies), preferences and intergenerational transmission of values and behaviour impact fertility. Although there have been recent advances in including new topics such as the biological and genetic underpinnings of fertility and new family forms, considerable challenges for future research still remain. The first is the availability and affordability of data with sufficient information such as biomarkers or genetic data, but also data that properly captures new types of family forms. Although growing, this type of data that combines genetic and social survey data remains limited. A second related issue, particularly for the introduction of serious biodemographic research, is the need to collaborate with experts and properly understand how to properly integrate this type of information and biological mechanisms in our theoretical, but also statistical models.

This review also highlighted core meso-level factors impacting fertility, including the emerging field of social interaction, social capital and networks and place of residence. Although a growing number of (primarily qualitative) studies started to address these meso-level factors, core challenges still remain. As noted previously, there is no large-scale quantitative network data that has been collected to examine how social networks impact fertility. Of the data that has been collected, the network measurements remained limited. This is partially attributed to the high costs of collecting such data, but also to the high respondent burden when gathering this type of information, which makes it difficult to include within an existing survey.

At the macro-level we summarized the key determinants that have been studied, ranging from economic and (un)employment trends, to policy measures, welfare regimes, value and attitude changes, historical and cultural continuities, contraceptive use and new reproductive technologies. As we noted previously, a key challenge for the credible integration of these macro-level factors for understanding fertility is the need to move from

purely theoretical discussions to more convincing empirical tests of this link. Although researchers often claim that macro-level factors such as the welfare regime constellation or societal values impact fertility (and other demographic) behaviour, there are few successful empirical attempts to empirically underpin these claims. At all levels we also addressed challenges related to reverse causality and confounding factors and for macro-level factors, the issue of the endogeneity of social policies and reverse causality, which will be discussed in more detail shortly.

Some more general problems of current research that we can draw from a broader reading of this review can provide opportunities in helping us to understand improvements for future research. Two problems that became apparent during this review were the clear boundaries between disciplines and geographical areas. First, research on fertility is highly multidisciplinary, i.e., researchers from several disciplines engage in explaining the timing and quantum issues surrounding fertility. However, there are limited instances of interdisciplinary research, simultaneously involving scholars from different disciplines or adopting theoretical and/or methodological approaches of different disciplines. Citation patterns are highly disciplinary-specific, with articles often ignoring clearly relevant research published from other disciplines. It is easy to say that research on fertility would highly benefit by crossing disciplinary boundaries more often, perhaps starting from reading each other's research more often.

A second related point is the relevance of geographic boundaries. Research on fertility on Europe (mostly conducted by European scholars) and research on fertility on North-America (mostly conducted by North-American scholars), or in other words, the bulk of research on fertility, often do not communicate with one another. This was apparent during several places during our review where conflicting theories and findings were presented from North-American and European scholars. Topics, approaches (including the type of data) and again citations remain somehow separated, albeit research in Europe has clearly been fundamental in illuminating the role of macro-level factors, largely due to the often cross-national comparative approach. Not surprisingly, scholars working on other advanced areas are more successful in bridging the two continents over the Atlantic. Also, here it is easy to say that a general understanding of fertility choices would be easier by bridging the findings and approaches related to all advanced societies.

Two additional problems are related to methods, data and analytical strategy, which once again are apparent when we stand back to reflect in more general terms from this literature review. First, and related to the international character of fertility research, despite efforts of developing comparative, mostly aggregate data (such as the Human Fertility Database by the Max Planck Institute for Demographic Research and the Vienna Institute of Demography), most research focuses on micro-data that do not usually permit highly comparable research. We could therefore improve fertility research by developing comparable data collection in many countries—including very importantly, the U.S. and Japan in micro-level comparative fertility research. This is even more important given

the increasing geographical mobility across countries. Only further collaborative efforts by researchers and funding agencies will enable us to uncover fundamental mechanisms operating at different levels and affecting fertility choices. Second, given that fertility can only be observed (as opposed to experimentally induced) by researchers, the issue of causation versus spurious association lingers as a major problem. Attention to causality is heterogeneous in the literature — undoubtedly with an advantage for studies arising from the tradition of economics. Causal interpretations are widespread also in studies that discover associations (which is a serious problem), but some studies clearly do not aim at understanding or studying causation (which is a lower-order problem related to how ambitious researchers and disciplines are). Further steps towards recognizing the importance of methods aimed at unravelling causality in observational data would contribute to conducting higher quality fertility research. Researchers and policy-makers alike would gain much more by adopting a program evaluation perspective for the evaluations of policies that might affect fertility choices.

Furthermore, our review uncovered that three problems emerge concerning the actual factors studied, ranging from individuals to context. Research on men, or in other words, the fertility of men and fatherhood, remains very limited, albeit growing. It is clear that a gendered approach is necessary, but this implies that both genders should play an equal role in our understanding of fertility choices. More research including both men and women would improve our knowledge. Related to this first problem is the second problem of couples. For both theoretical and (lack of) data-related reasons, fertility choices have been investigated mostly from an individual perspective. The limited research, and data, existing on couples show the incredible value of addressing fertility as a joint decision. A third problem relates to the limited knowledge of the importance of meso-level factors. Here the theory is more developed than the actual instruments such as the collection of quantitative data having a kinship and/or network-based approach, which we addressed previously. Efforts in using innovative analytical techniques such as agent-based modelling are promising. Recent innovative designs (e.g. the Add Health study in the U.S. or the Netherlands Kinship Panel Study) also provide some insights on future directions.

Finally, promising research avenues are those emphasizing the interaction of factors located at different analytical levels. As already mentioned in the *policies* and *welfare regime* sections, studies that adopt a cross-country comparative life course approach often position nation-specific institutions as path-dependent structures that shape micro-level individuals' characteristics and enable or inhibit the ability to have children and to have them at a particular period in their lives (i.e., during education, while remaining employed). National institutions or forces such as employment and education systems, welfare regimes, social policies, family, and gender systems are historically based and country-specific and determine the degree to which people are affected by macro-level changes (Mayer 2004). Micro-level factors, such as partnership status, might interact with the macro-level of institutions and culture. One example is the difference between

cohabitation and marriage as determinants of childbearing. Baizán et al. (2004) find that in Sweden such differences are almost negligible as compared to West Germany. Comparing the 1958 and 1970 birth cohorts in the UK, Steele et al. (2006), find that the links between cohabitation and childbearing have strengthened over time because of changing cultural forces. Women may decide to postpone childbearing to avoid marriage particularly in less gender-equal societies (e.g., Japan) because they do not want to be forced into motherhood and out of employment (Rindfuss et al. 2004).

Throughout this review we have already cited some studies that adopt a cross-country approach, showing how forces and constraints at the macro-level can impact micro-level dynamics. Kalwij (2010) and Begall & Mills (2011), for example, show how different welfare regimes and family policies can facilitate or constraint an individual's work-family balance.

McDonald's gender theory (2000a, 2000b) and related approaches (Chesnais, 1996; Esping-Andersen, 1996, 2009) are among the most relevant examples of interaction between micro-level factors (i.e., employment status and gender equity within the family) and macro-level factors, (i.e., welfare regime) (see also Cooke et al., 2010). McDonald claims that very low fertility occurs where and when high levels of gender equity in individual-oriented institutions, such as education and market employment, are coupled with low levels of gender equity in the family and family-oriented institutions. Put differently, if women are provided with opportunities near to equivalent to those of men in education and labour market systems, but these opportunities are then severely limited by having children because they cannot reconcile work and motherhood, then, on average, women will restrict the number of children. Although this theory has often been used in explaining low fertility, empirical applications are still lacking (see Mills 2010).

Another example of meso-macro interaction is the study of Balbo & Mills (2011). They show that social pressure and social capital are highly institutionally filtered, having a much stronger effect on an individual's intention to have another child in familistic contexts, that leave caring responsibilities to the family and encourage a male-breadwinner model.

The effects of social capital and social pressure on the intention to have a second or third child in France, Germany, and Bulgaria, 2004–05

3

This study investigates the importance of the effect of an individual's web of informal relationships with family and peers on the intention to have a second or third child. Drawing on sociological theories of social capital (help with childcare, emotional support) and social pressure, the study extends existing research by evaluating cross-national differences (between France, Germany, and Bulgaria) in the impact of personal network and institutional circumstances. It tests a non-linear relationship between social capital and fertility intentions. Social pressure and social capital are highly institutionally filtered, with the impact of personal network stronger where institutions are less family-supportive.

This chapter is based on:

Balbo, N., & Mills, M. (2011). Social capital and pressure in fertility decision-making: second and third births in France, Germany and Bulgaria. *Population Studies*, 65(3), 335-351.

3.1 Introduction

In recent years, research has amply demonstrated the importance of the influence of personal network on fertility behaviour (Kohler et al., 2001; Bühler & Philipov, 2005; Bernardi et al. 2007). Childbearing decisions are not made in a vacuum, but are influenced by the personal network in which they are embedded—the web of informal relationships that an individual shares with relatives and peers (McCarty, 2002). The aim of the study presented here was to extend previous research by testing the impact of the personal network on intention to have a second or third birth in France, Germany, and Bulgaria.

Two independent bodies of research have emerged in this area, each identifying a different role of the personal network. The first treats the network as the locus of social interaction, where individuals engage in the communication of expectations and are influenced by social norms or pressure (Kohler, 2001; Bernardi, 2003; Lubbers et al., 2007). The second strand of research, engendered by sociological theory (Lin et al., 2001; Flap & Völker, 2004; Mandemakers & Dykstra, 2008), focuses on the personal network as a source of social capital in the form of emotional and material aid (Bühler & Philipov, 2005; Philipov et al., 2006). Although both lines of research have inspired fertility studies, these have usually not been conducted in Western countries (Kohler et al., 2001; Bühler & Philipov, 2005). The only studies to investigate the effects of a personal network on fertility intentions in these countries (Bernardi, 2003; Bernardi et al., 2007; Keim et al., 2009) offer valuable insights but, because they were relatively small-scale qualitative investigations of carefully selected groups, could not support broad generalizations. The aims of the study presented here were to complement and extend knowledge about the effects of personal network on fertility in developed countries, using a comparative perspective, and to contribute to the growing body of research that looks beyond relationships with parents and siblings to demonstrate that individual action is affected also by the constraints and opportunities of the broader web of an individual's personal relationships (Wasserman & Faust, 1999).

Earlier studies that have used measures of social capital in fertility models have focused on particular ex-communist Eastern European countries, and in these countries social capital may be especially important (Philipov & Shkolnikov, 2001; Philipov, 2002; Philipov et al., 2006; Bühler & Fratczak, 2007). Further, in earlier studies personal networks have been studied exclusively in relation to individual factors, such as individual economic resources (Schoen et al., 1997; Bühler & Philipov, 2005; Philipov et al., 2006), with little attention to the role of institutions. We believed that a comparative approach that compared countries in Western Europe (France, Germany) with a country in Eastern Europe would be more revealing of the universal mechanisms that explain how personal networks affect fertility, and of how they might be influenced or filtered by differences in the framework of national institutions. National institutions shape the levels of support that individuals

receive from the state, market, or family, and constitute what is often described as the welfare regime (Esping-Andersen, 1990). These regimes influence the individual's need for support from the personal network, and thus its influence on fertility behaviour. Given that institutional regimes differ markedly between countries, we expected these differences to be reflected in major national differences in the relationship between personal network and fertility. Since the personal network is a source of social pressure on the individual as well as social support, we decided that it would be productive to investigate both in our study. The only previous study to do this was one in Poland (Bühler & Fratczak, 2007).

Previous studies of the effect of social capital on fertility have usually defined social capital as the number of providers of a resource—a definition that is strongly disputed outside demography. Influenced by ideas from the sociological literature on social capital, we believed that a more nuanced relationship between the size of the network and fertility intentions might be important. We therefore decided to examine both the positive and the negative effects of the number of providers, assuming a non-linear shape of the effects in relation to the number of providers for each resource.

The next section provides an overview of the theoretical framework, including the justification for examining second- and third-birth intentions, and hypotheses about the effects of social pressure and social capital. Next, we briefly compare the different institutional settings in France, Germany, and Bulgaria, and then describe the Generations and Gender Survey (GGS), which provided the data used in our study. These sections are followed first by the description of a series of binary logistic regression models, and then by the presentation and discussion of our results in relation to our expectations. In a concluding section we reflect on our findings in light of existing research and make suggestions for further research

3.2 Theoretical framework

The intention to have a second or third child

In the demographic literature, fertility is often investigated by studying both intentions and behaviour (i.e., having a child). Contemporary research that focuses on fertility intentions (e.g., Philipov et al., 2006; Billari et al., 2009) often draws upon the theory of planned behaviour (TPB) (Ajzen, 1991), according to which intentions are the result of the combination of three antecedents: (i) attitude (perceived costs and benefits) towards the behaviour in question; (ii) subjective norms about that behaviour (e.g., influence of close friends and relatives); and (iii) the extent to which the behaviour is perceived to be subject to control. It is assumed that the intention to perform a specific behaviour is the proximate antecedent of the behaviour, and that therefore factors which have an impact on intentions will also have an impact on behaviour.

In support of the theory, some studies have shown that intentions have strong explanatory power (Schoen et al., 1999; Berrington, 2004), and a direct effect on fertility behaviour. Others, however, remain sceptical about their predictive power (Quesnel-Vallée & Morgan, 2003; Toulemon & Testa, 2005), arguing that a proportion of intended births are not actually realized and vice versa. Although we acknowledge that fertility decision-making occurs within a context of changing constraints (Spéder & Kapitány, 2009), we embrace the TPB with the conviction that a careful investigation of fertility intentions can shed light on the forces underlying fertility decisions.

There were both substantive and practical reasons for focusing on second-birth and third-birth intentions and excluding first-birth intentions. The importance of factors that affect intentions to have a first child differ from those that affect having a second or third child. As Billari et al. (2009, p. 444) emphasized: '… intentions to have a first child are *de facto* intentions to become a parent … Intentions to have a second or a third child are affected by the previous life-course experiences of parenthood'. In this study, we were interested in examining the impact of social pressure and social capital on people who had already experienced the consequences of being in a network for having one child. The presence of a child allows the individual to assess what can or cannot be gained from the network. Moreover, from a practical point of view, focusing on second-birth and third-birth intentions allowed us to use a measure of the informal childcare support actually received, which would not have been possible had we studied first-birth intentions. We also opted to examine short-term intentions (i.e., intention to have a birth within 3 years), which are known to be more accurate than long-term intentions (Philipov, 2009), as would be expected. We limited the scope of the study to three children because it is now unusual to have more than three and those who do so are usually in categories with uncommon characteristics (e.g., religious, non-working women).

Decisions about childbearing are usually made by a couple (Thomson, 1997). Data restrictions did not allow us to use data on both members of the couple, but we took the partner's characteristics into account. Our method also took into account the fact that differences in the roles of men and women might translate into differences between them in membership and importance of a network, and access to it. Since differences in men's and women's roles are usually a reflection of the broader societal gender system (McDonald, 2000a, 2000b), we expected that country-level variation in the level of equity between men and women, both within and outside the family, might lead to differences between them in the impact of a personal network on fertility. Such differences would be consistent with the results of previous studies, which have linked both societal and household inequity between men and women to a lower likelihood of intending to have another child (e.g., Miller Torr & Short, 2004; Mills et al., 2008; Mills, 2010). For these reasons, we analysed men's and women's fertility intentions separately across the three countries.

Social pressure and social capital

The impact of the personal network on fertility intentions was examined applying the constructs of social pressure and social capital.

Social pressure. Most fertility studies that focus on social-interaction processes and communication networks (Bongaarts & Watkins, 1996; Kohler, 2001; Kohler et al., 2001) analyse the diffusion of contraceptive methods in less developed countries (Kohler et al., 2001) and the processes of social learning (how individuals gain knowledge from others) and social influence (how consensus in peer groups constrains attitudes and behaviour) (Montgomery & Casterline, 1993; Kohler et al., 2001). In developed countries, most studies of contemporary fertility behaviour have been inspired by the second-demographic-transition framework (Lesthaeghe & van de Kaa, 1986) and therefore assume that social pressure on childbearing decisions is disappearing. However, some studies have demonstrated that social pressure may also play a role in low-fertility developed countries (e.g., Rindfuss et al., 1988; Montgomery & Casterline, 1993). Liefbroer & Billari (2010), for instance, demonstrate the important role that social pressure plays on the timing, sequencing, and quantum of fertility in the Netherlands.

Qualitative research has uncovered mechanisms through which social influences affect reproductive behaviour (Bernardi, 2003; Keim et al,. 2009). Billari et al. (2009) and Rossier & Bernardi (2009) have also linked the TPB to social-network theories of fertility, showing how behavioural theories that explain fertility decision-making can be integrated into a quantitative network study. Using Bulgarian data, Billari et al. (2009) demonstrate that indicators of social pressure from members of the immediate personal network can be used to measure Ajzen's concept of the subjective norm (1991).

Following Bernardi (2003), we define social pressure as the individual's perception of what relevant others approve or disapprove of. The individual uses these perceptions to evaluate the social costs and benefits of acting on or ignoring the opinions of relevant others. For our study we took into account the opinions of parents, relatives, and friends in the personal network. The partner was not included as we assumed that he or she was already actively involved in the individual's fertility decision-making. This reasoning led us to our first hypothesis:

H1: The greater the social pressure exerted on an individual to have another child, the greater the likelihood that she or he intends to have another child.

Social capital. Another body of fertility research, inspired by sociological theory, uses the concept of social capital (e.g., Philipov et al., 2006). Social capital comprises resources to which individuals have access as a result of personal relationships and can include goods, information, money, access to work, influence, power, or active help (Granovetter, 1973; Bourdieu, 1986; Coleman, 1988). Building on previous applications by sociologists (Granovetter, 1973; Bourdieu, 1986; Lin et al., 2001; Flap & Völker, 2004), recent

demographic studies have demonstrated how social capital can enable individuals to make the best use of economic and cultural resources in achieving their goals (e.g., Schoen et al., 1997; Bühler & Philipov, 2005; Philipov et al., 2006).

The inclusion of social capital among the determinants of fertility means that these determinants can encompass such resources as informal help with childcare. Bühler & Philipov (2005) provide an extensive theoretical discussion of how social capital is related to social network and how it affects the formation of fertility intentions where fertility is low. Building on these ideas, we assumed that supportive social relationships would have a positive impact on fertility intentions. Previous studies have focused on ex-communist Eastern European countries in which high levels of economic uncertainty make network support crucial (Philipov & Shkolnikov, 2001 and Philipov, 2002 for Russia; Philipov et al., 2006 for Bulgaria and Hungary; Bühler & Fratczak, 2007 for Poland). Because it also included Western countries, our cross-national comparative design made it possible to test the effects of national differences in institutional arrangements.

Snijders (1999) explains that when investigating the role of social capital relative to a specific goal, it is necessary to focus on the resources that are instrumental in reaching that goal rather than on the social ties that generate the resources. There are various fertility-relevant resources in a typical personal network on which a parent might be able to draw and that would contribute to the parent's social capital. For instance, it would include any support (e.g., childcare or household chores) that could help a parent better allocate or save time and economic resources. Because no comprehensive and effective measure for such a multidimensional concept was available to us, and prompted by previous research on social support (Van Busschbach, 1996), we decided to focus on two specific and well-established resources that had previously been shown to be crucial for childbearing choices: informal childcare support (Hank & Kreyenfeld, 2003) and emotional support (Bühler & Philipov, 2005).

Within the sociological literature, generic definitions of social capital emphasize the reciprocal and trust-based nature of the exchange of social capital (Van der Gaag, 2005). Fertility studies have operationalized this feature of reciprocal exchange in referring both to resources that individuals are already exploiting and those to which they potentially have access if and when required (e.g., Bühler & Philipov, 2005). We acknowledge the importance of this feature of social capital, but the cross-national data available to us did not include comparable information about the exchange of potential resources. The exclusion of a measure of reciprocal exchange was not overly detrimental to our analysis since we focused on people who already had children, and thus on those who had already experienced how and to what extent the personal network could offer support relevant to childbearing and childrearing. We adopted the view that, when making choices about future childbearing, people were more likely to base their decisions on previous experience

of the support they had received (Billari et al., 2009) than on potential new social ties they might exploit in the future.

Social capital is a multidimensional and complex concept, and ways of measuring it have been the subject of much debate. Usually fertility researchers have measured the social capital in a network by the number of providers of a specified resource in the network (Bühler & Philipov, 2005; Bühler & Fratczak, 2007), on the assumption that returns are proportional to the number of providers. When there are more providers than needed of the same resource, they are seen as a form of 'insurance'—available when the main provider is unavailable. However, outside demography, the validity of measuring social capital in this way has been subjected to criticism in recent reports of network studies (Oorschot & Finsveen, 2008). Van der Gaag (2005) showed that the assumption that returns are proportional to the number of providers does not apply in the case of many goals, since often they can be achieved with limited support. Snijders (1999) claims that in several cases the marginal utility and the value of the support of one provider who gives access to a resource that is not yet available is higher than the support of additional providers who give access to the same resources. Finally, Borgatti (1998) demonstrates that the availability of more providers than needed can even be inconvenient, because it can create coordination problems and, owing to the fact that social capital is based upon reciprocal exchange, entail more obligations and therefore diminishing returns from reciprocity.

Guided by this literature, we operationalized social capital in a way that allowed us to test two possible alternatives to the null hypothesis of no effect of social capital on fertility intentions. We examined the number of providers, but also considered the shape of the effect in relation to the number of providers for each resource. Following the same reasoning applied for social pressure, the partner was again not included among the resource providers. Our hypotheses were:

H2a: The higher the number of providers of each relevant resource within an individual's personal network, the greater the likelihood that an individual intends to have another child.

H2b: Social capital has a curvilinear effect on the likelihood of intending to have another child: the presence of only one provider for each relevant resource within a personal network leads to the highest likelihood that the individual intends to have another child.

3.3 Different institutional settings

A central shortcoming of previous research on personal networks is that cross-national variation was not taken into account, despite growing recognition that only a comparative study could reveal the influence of cultural and institutional factors on the relationship between personal network and fertility (Billari et al., 2009; Keim et al., 2009; Liefbroer & Billari, 2010). To reveal that influence, such a study would need to be of countries that

Table 1: Key economic and demographic figures for France, Germany and Bulgaria, 2004–05

Country	GDP per person	Unemployment rate	Women's unemployment rate	Total fertility rate	Mean age at first birth
France	29.7	8.9	9.8	1.94	28.5
Germany	31.4	11.1	10.7	1.3	29.6
Bulgaria	9.3	10.1	9.8	1.3	24.8

Notes: 1GDP per person in US$, at prices and PPPs of 2005
Source: UNECE Statistical Division Database, 2005

offered significant differences in these factors. The marked differences in economic and demographic features between the countries used in our study—France, Germany, and Bulgaria—are summarized in Table 1. This section offers an outline of family policy and gender systems in each country. The systems are summarized in Table 2.

French family policy and gender system

In France, childcare support has long been a priority. There are well-established state and private arrangements for the care of children under 3 years of age, which help women reconcile family responsibilities with the demands of employment (Toulemon et al., 2008). These arrangements have substantially relieved the household of welfare and caring responsibilities. In the provision of childcare, the state has become a substitute for the family, and has done so in the interest of social equity and the encouragement of childbearing (Rosental, 2003). The result has been to promote relatively high and stable fertility coupled with the increasing participation of women in the labour market (OECD, 2005) and a shift towards dual-earner families (Toulemon et al., 2008). In contemporary France, the man-as-breadwinner model has become socially discredited and the division of domestic tasks between men and women more equal than in most other European countries (Eurostat, 2006).

German family policy and gender system

Germany is a relatively familistic country. Childcare is mainly the responsibility of parents. The state supports long-term parental leave and provides allowances. Private childcare is scarce and public childcare is often inadequate, both in quality and quantity (see Hank & Kreyenfeld 2003). Because childcare for very young children is virtually non-existent, most women have to choose between family responsibilities and work. They usually withdraw from the labour market when a child is born (Dorbritz, 2008).

In Germany, mothers are often inhibited from using out-of-home care, particularly for young children, by strong normative pressure against doing so. German family policy has sustained the traditional man-as-breadwinner model, the influence of which is evident in

all institutions, including the tax system. The woman-as-homemaker model remains very popular, particularly in the West, and the division of household roles between the partners is often traditional, especially when children are in the household (Grunow et al., 2007). As a consequence, the dual-earner pattern is not common except among childless couples. Women with children are usually economically inactive or in part-time employment. Starting from around 2000, a slow shift towards a less familistic model is discernible, but most of its effects have occurred beyond the period of this study.

Bulgarian family policy and gender system

In contrast to Germany, Bulgaria has moved from a system in which the state provided childcare to one in which the family has become responsible for it. Like many post-socialistic countries, Bulgaria combines the dual-earner model with a very traditional and inequitable division of roles between men and women (Wallace et al., 2006). The adoption of childcare responsibilities by the family has been attributed to the abrupt end of the state's capacity to continue to provide the generous care system that was available in the communist era (Todorova, 2000; Kovacheva & Pancheva, 2003; Zhekova & Kotzeva, 2005). Changes in the political regime resulted in severe cutbacks in public expenditure and a dramatic decrease in the number of places in childcare (Koytcheva & Philipov, 2008). The household with two full-time earners typical in the communist era remains predominant in contemporary Bulgaria, but women's participation in the labour market is now often an economic necessity.

Different institutional conditions and fertility intentions

As Esping-Andersen (1999) and Brewster & Rindfuss (2000) note, the relationship between fertility and the state's provision of childcare services is increasingly positive and supported by the now positive relationship between women's employment and fertility. In the USA, however, where fertility is above replacement levels, the family continues to provide childcare. According to McDonald (2000b), this can be explained by the fact that

Table 2: Main features of family policy and gender system in France, Germany and Bulgaria, 2004–05

Country	Family policy	Gender system
France	Almost universal public childcare	• Dual-earner model • Relative equality between men and women in family roles
Germany	Inadequate public childcare	• Man-as-breadwinner model • Traditional family roles for men and women
Bulgaria	End of generous socialist system of social care	• Dual-earner model • Very traditional • Women inequitably burdened

family-related institutions in these countries have adapted more rapidly to the model of an egalitarian division of responsibilities between men and women.

We also investigated how the transfer of childcare responsibilities to the state and the equitable division of functions between men and women shape the relationship between personal network and individual fertility. We assumed that an individual's need for the help of others is directly influenced by the availability of institutional support, and that the extent to which family, relatives, and peers place pressure on an individual's childbearing decisions differs according to the importance of the role they are expected to perform by the state.

In a familistic country, such as Germany or contemporary Bulgaria, where households and families bear principal responsibility for their members' welfare (Esping-Andersen, 1999), an individual is likely to need more support from a personal network than would be needed elsewhere. Owing to a household's size or lack of resources, its members may be unable to carry the full burden of childcare responsibilities and may therefore require support from relatives and peers outside the household. Since individuals rely more heavily on support from the family and the personal network in familistic countries, we can also assume that they are more likely to be subject to opinions and pressure from the personal network in these countries. This reasoning led us to formulate the following cross-national variants of the first two hypotheses presented earlier:

H3: In a familistic country such as Germany or contemporary Bulgaria, the effect of social pressure on intention to have another child is stronger than in a country like France, where the state makes provision for childcare.

H4: In countries like France, the state's provision of care leads to a lower need for informal support, whereas the limited support from the state in familistic regimes like those in Germany and contemporary Bulgaria increase the importance of social capital for the intention to have another child.

3.4 Data and method

Data and sample

Our data were from Wave 1 of the Generations and Gender Survey (GGS), conducted in Bulgaria (2004), France, and Germany (both 2005). The GGS is a cross-national, large-scale panel survey of nationally representative samples of men and women aged 18–79 years in European and non-European countries (Vikat et al., 2007). In addition to providing individual and household-level data, the survey also collects information about social pressure and social capital in a respondent's personal network. Owing to the scale of the survey, it was not practical to ask respondents to name important individuals in their personal network. Instead, the GGS asked respondents to indicate which persons

had provided a specific resource from a list of pre-defined providers, who were identified by the relationship they had with the respondent (parent, child, grandparent, friend, etc.). The GGS is the only cross-national survey to date that collects information on personal networks. We are aware that the German GGS suffers from possible sample selection bias (Kreyenfeld et al., 2010), but this shortcoming was not a problem for the examination of fertility intentions.

To ensure that the fertility intentions elicited were as realistic as possible, we used a subsample of respondents, comprising women and men with the following characteristics: age within the reproductive age range of 18–45 years; living with a partner; parent of one or two children, with the youngest not older than 14; reported as fertile and not pregnant. Separate analyses were estimated for men (N=1,504) and women (N=2,255). See Table A1 for descriptive statistics for each country. Because it is likely that most people intend to have an additional child within 5 years of the previous birth, we also ran separate analyses using a restricted sample of people with the youngest child not older than 5 years. The results (not shown) were virtually identical to those using the full sample.

Measurement of variables

Fertility intentions. The dependent variable was the likelihood of intending to have a second or third child within 3 years. Preliminary analyses separated by parity produced virtually identical results, justifying the decision to collapse second and third births into one group. Childbearing intention was elicited with the following question: *Do you intend to have another child during the next three years?* The four possible responses were: *Definitely yes, Probably yes, Probably no, Definitely no*. We collapsed the two 'yes' and two 'no' responses into one positive and one negative response, because the use of a binary logit model would simplify the interpretation of results. Preliminary analyses using an ordered logit model had shown that the collapsed and uncollapsed responses produced essentially similar outcomes.

Social pressure. Social pressure was measured by examining how the respondent perceived the opinions of others about how she or he should behave. Specifically, we measured to what extent the respondent felt social pressure to have a child from parents, relatives, and friends, using the following three items: *Most of your friends think you should have another child, Your parents think that you should have another child, Most of your relatives think you should have another child.* The possible responses ranged from *Strongly agree* to *Strongly disagree*. The three variables were collapsed into one continuous index (Cronbach's alpha = 0.93)

Social capital. Social capital was operationalized by identifying and measuring two resources relevant to decisions about childbearing. The first resource was help with childcare. The questions were: *Do you (also) get regular help with childcare from relatives or friends or other people for whom caring for children is not a job? From whom do you get*

this help? The second resource was emotional support. The questions were: *Over the last 12 months, have you talked to anyone about your personal experiences and feelings? Whom have you talked to?* In response to each of these questions, the respondent could indicate up to five people from the list of possible providers described above.

To test whether social capital had either a curvilinear or an increasingly positive effect on childbearing intentions (hypothesis 2), we created three response categories: *No support* (*no provider*), *Support from only one provider* (if the respondent had indicated only one person), and *Support from more than one provider* (from two to five providers). Since our aim was to evaluate the influence of the social network outside the household unit, we excluded the partner from this measurement. Moreover, we could not include both support received and support given (as Bühler & Philipov, 2005 had done) as a proxy for the reciprocal nature of social capital, because the two measures of support (i.e., received and given) were highly correlated.

Control variables. To avoid a spurious association between our explanatory variables and childbearing intentions, we controlled for several socio-demographic characteristics of the respondent and the partner. Quantitative and qualitative research has shown that individuals incorporate the partner's attitudes into the formulation of their own intentions (Thomson, 1997; Bernardi et al., 2007). We could not include a measure of partner's intention because the variable was not comparable between partners (for the partner we have the intention to have a child *now*, while for the respondent we use the intention to have a child within 3 years) or among countries (France has a different question in the questionnaire).

Given the non-linear relationship between age and fertility, we controlled for the age group of respondent. We also controlled for number of children (one or two, natural or adopted), and age of the youngest child. Controlling for the number of children allowed us to distinguish between intentions to have a second or a third child. We expected that individuals with only one child, and especially a young one, were more likely to intend to have another child.

Two dummy variables were used to control for the employment status of the respondent and partner. We also controlled for the highest educational level achieved by each partner, since these levels were not highly correlated. We included these variables because they have an effect on the amount of time and economic resources that an individual can (or cannot) devote to childrearing. We could not control for whether the individual used any source of formal childcare because every respondent claimed to make regular use of it (i.e., the variable was constant for each observation). This result was probably a consequence of the form of the question, which included in formal childcare 'regular help with childcare from day care centre, a nursery or pre-school, an after-school care-centre, a self-organized childcare group, a babysitter, or from other institutional or paid arrangement'.

We also controlled for the degree of partner's support, because it seemed likely to affect the need for help outside the household unit. Partner's support was measured by the couple's division of housework: the regular contribution of each partner to four household tasks—preparing daily meals, cleaning dishes, shopping for food, vacuum cleaning. For each task, the respondent was asked to indicate who performed it. The possible responses were: *Always respondent, Usually respondent, Respondent and partner equally, Usually partner, Always partner*. We then computed an index (Cronbach's alpha=0.87) that increased when the partner's participation in housework increased. Following Torr & Short (2004), we also checked for a curvilinear relationship between partner support and childbearing intention, but did not find this relationship.

Finally, we controlled for the partnership status of the couple (cohabitation vs. marriage), and for the household's economic situation. It was important to control for these household characteristics because they are well known to affect childbearing intentions and can also influence the extent of social pressure (for different types of union) and the need for social support. The household's economic situation was measured with a continuous variable that used the respondent's subjective assessment of household income in response to the question: '*A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total monthly income, is your household able to make ends meet …*' The possible responses were scores on a scale from 1 to 6, with *1=with great difficulty* and *6=very easily*.

Analytic strategy

We estimated binary logistic regression models of the probability of intending to have another child within 3 years. To explore differences between women and men in the relationship between personal network and fertility, we estimated models separately for men and women.

We first pooled the analysis of the three countries, with country dummies to control for between-country variation (Models 1 and 3, women and men, respectively). This allowed us to test our general hypotheses (H1, H2) about the role of the personal network in childbearing intentions. We then included interaction terms in the model between the variable of interest and country dummies to test whether differences in institutional arrangements between countries affected the intensity of the effects of social pressure and social capital on childbearing intentions (H3, H4). We opted for pooled logistic regression models with interactions rather than analyse the countries separately, to allow a test of whether country differences were statistically significant.

The results presented include only interaction terms that were statistically significant (Wald test) for at least one sex. To maintain comparable models for men and women, we included the same interaction terms for both sexes, even when it was significant for only one of them. All continuous variables were centred to avoid problems of multicollinearity.

3.5 Results

Our results are shown in Table 3, which reports the odds ratios of intention to have a second or third child. Models 1 and 3 represent the two basic models with main effects and country dummies for women and men, respectively. Models 2 and 4 show the interaction terms.

Women and men are more likely to intend to have another child within 3 years when they are between 25 and 30 years old. The much lower probability for women over the age of 36 years does not apply to men until they reach their 40s. Both sexes are less likely to intend to have a third child than a second one, with the age of the youngest child playing a pivotal role. The older the youngest child, the lower is the intention to have an additional child.

Both sexes are also less likely to intend to have another child in Germany and Bulgaria than they are in France. This was to be expected from the descriptive statistics in Table A1, which show a higher proportion of people with positive childbearing intentions in France than in Germany and Bulgaria. Also as expected, there are more people with two children in the French sample than in the samples for the two other countries.

For both partners, a higher education level is associated with a positive childbearing intention. Interestingly, a more positive assessment of household income does not lead to a positive childbearing intention for women, but does so for men. This difference has also been found in previous studies (Mills et al., 2005). Moreover, for men, only their own educational attainment level has an effect, while for women, her partner's level of education also has an effect. These findings reflect the classic man-as-breadwinner logic. Women appear to rely on their partner's employment status (which is related to his educational level) for the household's economic security. Women's childbearing intentions are, however, less driven by narrow economic reasons. It appears rather that women are more concerned with time constraints and work–family conflict. More educated women have a higher probability of intending to have another child, which is probably because they are more likely to have more of the resources and skills needed to reduce work–family conflict, and because they are more likely to have partners who contribute substantially to household chores and childcare (Oláh, 2003; Torr & Short, 2004; Köppen, 2006; Mills et al., 2008).

Men appear to base their fertility intentions on an evaluation of the household's economic situation. This is directly related to their own employment, for which educational level is a proxy. Greater support from the partner in domestic activities appears to have no effect on men's and women's fertility intentions. However, this finding might be an artefact of the sum of different country effects. As McDonald (2000a, 2000b, 2006) has speculated, the effect of an equitable division of tasks in the family is likely to differ between countries with different institutional arrangements.

Table 3: Effect of social capital and social pressure on intention to have a second or third child, for men and women in France, Germany, and Bulgaria, 2004-05: odds ratios of the logit models

	WOMEN		MEN	
	Model 1	Model 2	Model 3	Model 4
Variables	Exp(B)			
Constant	0.964	1.009	0.543	0.615
Age group (ref: 31-35)	1	1	1	1
18-24	1.351	1.339	0.843	0.754
25-30	1.413**	1.396*	1.599**	1.643**
36-40	0.350***	0.350***	0.756	0.769
41-45	0.203***	0.198***	0.313**	0.340**
Number of children (ref: 1 child)	0.186***	0.189***	0.148***	0.153***
2 children				
Age of the youngest child	0.894***	0.893***	0.832***	0.826***
Country (ref: France)	1	1	1	1
Bulgaria	0.225***	0.180***	0.450***	0.351***
Germany	0.351***	0.374***	0.454**	0.408**
Perceived security	0.975	0.969	1.150*	1.137*
Partnership status (ref: married)	0.888	0.906	0.816	0.804
Cohabiting				
Employed	0.837	0.836	1.102	1.004
Partner's employed	1.129	1.100	1.370	1.381
Education (ref: secondary)	1	1	1	1
Primary education	1.310	1.300	1.234	1.212
Higher education	1.321*	1.328*	1.718**	1.684**
Partner's education (ref: secondary)	1	1	1	1
Primary education	0.792	0.799	1.066	1.057
Higher education	1.573**	1.567**	0.977	0.972
Partner support	1.152	1.138	0.973	0.965
Social pressure	1.311***	1.234***	1.282***	1.164***
Emotional support (ref: no support)	1	1	1	1
From 1 person	1.283	1.297	1.194	1.239
From more than 1 person	1.351*	1.339*	1.594**	1.571**
Childcare support (ref: no support)	1	1	1	1
From 1 person	0.889	0.905	0.902	0.681
From more than 1 person	1.077	1.032	1.303	1.505
Interaction terms				
Social pressure x country	1		1	
Social pressure x Bulgaria	1.121**		1.201**	
Social pressure x Germany	1.061		1.157**	
Childcare support x country	1		1	
From 1 person x Bulgaria	1.181		1.129	
From more than 1 person x Bulgaria	1.020		0.856	
From 1 person x Germany	0.593		2.973*	
From more than 1 person x Germany	1.148		0.328	
Nagelkerke R Square	0.539	0.543	0.559	0.571
N	2255	2255	1504	1504

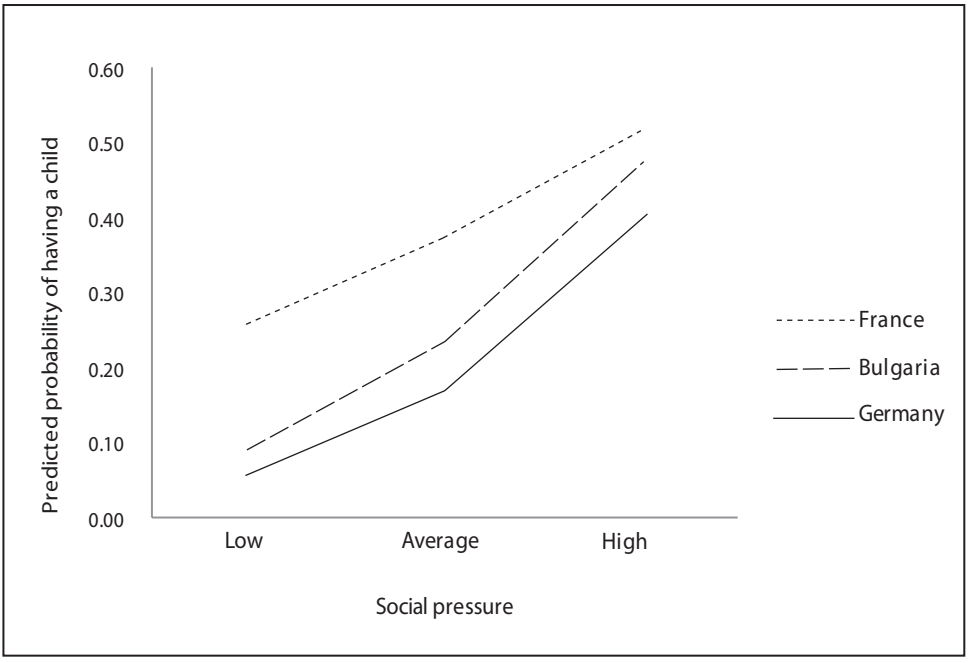
Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.
Source: French, German, and Bulgarian GGS (2004/2005)

For both sexes, social pressure from parents, relatives, and friends appears to have a strong positive effect on fertility intention. This result supports our first hypothesis and is consistent with previous findings (e.g., Billari et al., 2009). The results for social capital are more mixed: informal childcare support appears to have little effect on fertility intention, but we do find a positive effect for hypothesis 2a in the case of emotional support: the higher the number of providers of a relevant resource, the greater the likelihood that an individual intends to have another child. This result may be explained by the 'insurance effect'—when one confidant is not available, the respondent can rely on others. Another possible interpretation is that having several people with whom an individual can discuss personal matters is symptomatic of a social environment conducive to sharing and supporting child-related worries.

Models 2 and 4 include the interactions between our explanatory variables and country dummies to examine whether and how social pressure and social capital affect fertility intentions in the three countries. Adding interaction terms does not change the effect of any control variables.

The interaction between social pressure and country is highly significant. The descriptive statistics (Table A1) show that the strongest social pressure is reported in Bulgaria and we

Figure 1: Predictions of country-specific effect of social pressure on men's intention to have another child. French, German, and Bulgarian GGS (2004/2005). Predicted probabilities are calculated using mean values for each country. Low and high social pressure are calculated at -1 and +1 standard deviations from the mean value of social pressure for each country.
Source: As for Table 3.

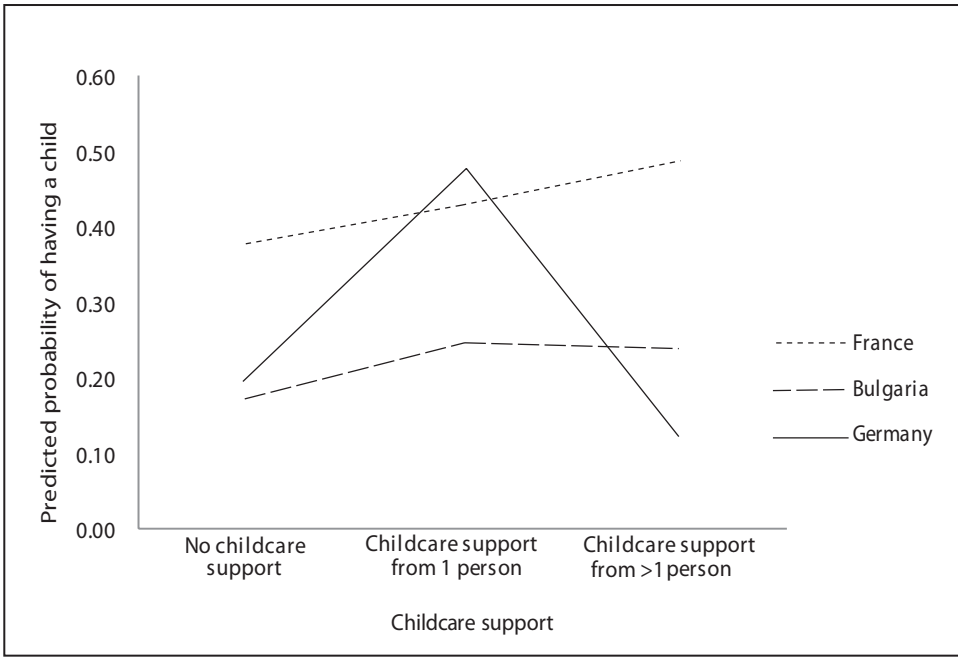


see that the positive effect of higher social pressure on fertility intentions is stronger in Bulgaria than in France for both sexes. For men, we also find a stronger effect in Germany than in France. Figure 1 shows the country-specific effects of social pressure on the predicted probability that men intend to have another child. We see that as social pressure increases, individuals in Bulgaria and Germany almost reach the probability of having another child of their French counterparts. This finding supports hypothesis 4: where caring responsibilities are largely the responsibility of the family and personal network, the individual is more exposed to the social pressure of the personal network.

Since the interaction between emotional support and country did not significantly improve the model for either of the sexes, we did not include it. There seem to be no significant differences between the three countries in the positive effect of emotional support from the network on fertility intentions.

No specific differences in the effects of informal childcare on intention are found for women in any of the countries, but the effect on German men differs from the effect on men in France and Bulgaria. Childcare support from only one provider seems to have a significant positive effect on German men's fertility intentions. Figure 2 shows that, in contrast to the other two countries, the relationship between childcare support and

Figure 2: Country-specific effect of informal childcare support on men's intention to have another child. French, German, and Bulgarian GGS (2004/2005). Predicted probabilities are calculated using mean values for each country.
Source: As for Table 3.



fertility intention for German men has a clear inverse U-shaped pattern. In other words, the likelihood of intending to have another child is low when there is no support, increases when support comes from one person, and then drops again when several providers are involved. The result might be attributable to the problem that receiving help from several people can result in coordination problems, with many potential providers being seen as a constraint rather than a source of support.

But why would there be a difference between countries in the need of support for men and not for women? Since the year 2000, the German government has been moving towards a family and welfare model that encourages the participation of mothers in the labour market. In consequence, with the steady erosion of the man-as-breadwinner family model and with such institutions as the labour market ceasing to be exclusively institutions for men (McDonald, 2000b), they are forced to rethink their roles. Even though the primary burden remains on women, men increasingly need to cope with the new double role of 'working father–family carer'. They might, therefore, need to rely on informal childcare support as much as or even more than women.

3.6 Conclusion

This study had several key goals. The primary one was to extend existing research on the impact of personal network on fertility intention by showing the importance of taking personal network into account as a source of both social capital and social pressure. We also wished to investigate a mechanism proposed in the sociological literature to explain the relationship between social capital and the intention to have another child. And finally, we wished to discover how the effects of social pressure and social capital on fertility intentions varied between countries with different institutional arrangements.

Our analysis demonstrates that social pressure and social capital affect fertility intentions for second and third children. The findings indicate that heightened social pressure from parents, relatives, and friends increases the likelihood that a parent intends to have another child. An individual is also more likely to intend to have another child when he or she receives emotional support from several people—a result that applies to both sexes.

Drawing on the demographic and sociological literature on social networks, we identified two possible ways in which social capital might influence fertility. One possibility was that social capital has a positive effect on fertility intention that is proportional to the number of providers of a specified resource. Our results show that this mechanism appears to apply to the effect of emotional support on fertility intention. A second possibility was suggested by the sociological literature: a curvilinear pattern, according to which the availability of a resource from only one provider is associated with a positive fertility intention, with diminishing returns for a greater number of providers. We found evidence of a curvilinear effect of informal childcare on German men's intention to have another child.

The study was the first to undertake a cross-national comparison of the effect of personal network on fertility. We expected social pressure and capital to have a weaker effect in France than in Germany and Bulgaria because in France the state makes generous provision for childcare, and the individual is less dependent on a personal network. Our findings support this hypothesis, showing that higher social pressure has a considerably stronger effect on fertility intentions in Germany and Bulgaria. Negative pressure (i.e., when relevant people discourage individuals from having children) is likely to operate in a similar manner. Where family provision for childcare is important, negative pressure might therefore be more effective than in other countries, perhaps leading to lower fertility.

While we found no differences between countries for the positive effect of emotional support on fertility intentions, a noteworthy effect is the impact of informal childcare support on the fertility intentions of German men. Their likelihood of intending to have another child increases when they receive help with childcare from only one person, though not (perhaps because coordination problems discourage further childbearing) when help is provided by more than one person.

The different models estimated for men and women show that the fertility intentions of German men, but not those of German women, seem to be strongly affected by the personal network. A possible explanation is that since family policy in Germany is increasingly becoming less family-friendly, men are facing changes and challenges to their roles.

In preliminary analyses (results not shown) we found that in all countries the greatest share of childcare support comes from close family members (especially grandparents and siblings), while friends play the main role in providing emotional support and exerting social pressure (especially in Germany). These results suggest that in these increasingly individualized societies, it may be more difficult to find support outside the family of origin. However, relationships with friends may be more influential than those with family members in exerting social pressure and imposing social norms. Clearly, this is an area that would warrant further, detailed research.

It is important to acknowledge some limitations of our analyses when interpreting the results. First, we know from previous literature (Kravdal, 2001, 2007) that studying second and third births, and therefore only focusing on people who already have one child, entails a selection bias. Although there is no consensus on how problematic this selection bias might be and how it should be addressed, it needs to be borne in mind. Second, what we could do was of course constrained by the data available. Quantitative data suitable for the study of personal network and fertility is hard to find (Rossier & Bernardi, 2009). The paucity of suitable data is partly attributable to the fact that this area of research is relatively new, but it is also because obtaining exhaustive information about an individual's network requires complex and time-consuming data collection. Our analyses are based on cross-sectional data, since there is currently no cross-national panel data on this topic. The GGS

is the only survey that allows us to adopt a comparative perspective using information on personal network. Although we assume that the relationships between social pressure and fertility intention and between social capital and fertility intention are causal, the use of cross-sectional data leaves that assumption open to question. We therefore acknowledge that our analyses are subject to some concerns about endogeneity (e.g., people who intend to have another child might be more sensitive to social pressure). As further waves of the GGS become available, future research could address these issues. Another interesting extension would be to include more countries and make use of a structured multilevel analysis to take into account the nested sources of variability in fertility (e.g., country-level and individual-level variance) and other macro-level variables affecting fertility.

Given the crucial importance of an individual's personal network on fertility, we hope that new, more complete data on networks will be collected. Fertility research would greatly benefit from a more comprehensive analysis of social networks. In addition to a more accurate analysis of network composition (e.g., availability of resources), a structural analysis would make it possible to assess the network of power and influence, strong and weak ties, and the role of specific subgroups. Studying both compositional and structural aspects of the personal network could reveal further mechanisms through which fertility was affected.

Appendix A

Appendix Table A1. Descriptive statistics: Percentage distributions of the variables included in models of the effects on social capital and social pressure on intention to have a second or third child for men and women in France, Germany, and Bulgaria, 2004-05

	Men			Women		
	Bulgaria	**Germany**	**France**	**Bulgaria**	**Germany**	**France**
Fertility intentions in 3						
Positive	26.5	19.3	31.9	20.8	19.6	33.2
Negative	73.5	80.7	68.1	79.2	80.4	66.8
Age Group						
18-25	4.7	4.8	2.9	10.2	7.5	8.5
26-30	17.4	11.1	13.9	26.6	16.8	15.0
31-35	35.8	20.8	28.8	35.7	27.8	35.1
36-40	26.9	37.0	34.3	18.8	33.8	26.1
41-45	15.1	26.2	20.1	8.7	14.2	15.2
Number of children						
1	52.8	44.6	35.0	47.1	40.7	36.2
2	47.2	55.4	65.0	52.9	59.3	63.8
Partnership Status						
Married	87.5	90.1	71.0	88.2	87.5	71.2
Cohabiting	12.5	9.9	29.0	11.8	12.5	28.8
Education						
Primary education	20.5	8.9	15.0	17.0	10.6	11.4
Secondary education	64.7	59.7	54.9	51.6	63.9	46.2
Higher education	14.8	31.4	30.1	31.4	25.5	42.4
Partner's education						
Primary education	19.7	15.8	15.2	16.9	5.7	14.3
Secondary education	56.8	65.9	48.2	63.0	60.1	54.0
Higher education	23.5	18.3	36.6	20.1	34.2	31.7
Employment Status						
Not employed	19.3	9.6	6.2	36.7	46.5	24.8
Employed	80.7	90.4	93.8	63.3	53.5	75.2
Partner's Employment Status						
Not employed	41.4	56.9	24.3	17.6	9.3	5.1
Employed	58.6	43.1	75.7	82.4	90.7	94.9
Emotional support						
No support	61.2	74.1	61.3	38.3	50.7	24.6
Support from 1 provider	20.4	13.6	19.5	31.9	26.1	34.1
Several providers	18.3	12.3	19.2	29.8	23.1	41.3
Childcare support						
No support	64.2	75.0	57.5	64.7	65.9	53.8
Support from 1 provider	16.9	14.8	22.1	19.0	18.8	17.8
Several providers	18.9	10.2	20.4	16.3	15.3	28.4

	mean	*sd*	*mean*	*sd*	*mean*	*sd*	*mean*	*sd*	*mean*	*sd*	*mean*	*sd*
Age youngest child (0-14)	6.26	4.37	5.37	4.02	4.37	3.87	6.94	4.33	5.28	4.16	4.88	4.10
Partner's support (1-6)	3.88	0.63	3.51	0.46	3.63	0.72	1.94	0.63	2.31	0.38	2.14	0.68
Social pressure (3-15)	7.29	3.59	5.32	3.55	6.18	3.69	6.97	3.54	5.67	3.60	6.26	3.59
Perceived security (1-6)	2.30	1.08	3.76	1.12	3.39	1.21	2.40	1.05	3.79	1.11	3.48	1.14

Notes: Sub-sample of women and men aged 18-45, with a co-resident partner, one or two children (the youngest not older than 14), being fertile and not pregnant.
Source: French, German, and Bulgarian GGS (2004/2005)

The influence of the family network on the realisation of fertility intentions

4

The gap between fertility intentions and behaviour remains a contentious area of theoretical, methodological and policy debate. Previous fertility studies have focused on individual and institutional characteristics, at the expense of the recognition of meso-level family social capital and networks. This study examines the realisation of time-dependent fertility intentions for the transition to first and higher-order births. Building upon and extending the previous literature we explore two competing theoretical mechanisms of how high levels of family social capital operate to either enable or inhibit the realisation of intentions and the impact of cross-sibling effects. Using two waves of the Netherlands Kinship Panel Survey (NKPS), we also introduce a methodological extension by examining whether the inclusion of only those with positive fertility intentions in previous research has resulted in selection bias. By adopting a probit model with sample selection, we both avoid this selection problem and empirically test whether there is a bias. Results show that there are some, albeit negligible, unobserved characteristics affecting both an individual's fertility intentions and the realisation of these intentions. High levels of family social capital operate to deter from having a child, particularly when individuals already have at least one child, suggesting that individuals adopt a 'satisficing' strategy. Our findings also suggest that children may operate as a means to generate family social capital. Having a sibling with a young child is associated with a higher probability to realise one's own intention to have a first child.

This chapter is based on:

Balbo, N., & Mills M. (2011). The influence of the family network on the realisation of fertility intentions. *Vienna Yearbook of Population Research*, 19, 187-215.

4.1 Introduction

Why do people not realise their fertility intentions? Morgan & Taylor (2006) suggested that it is precisely this question that needs to be addressed in order to understand contemporary low fertility. Several researchers have argued that the postponement or abandoning of fertility intentions may be an underlying driver of low fertility (Hagewen & Morgan 2005; Spéder & Kapitany 2009). It is moreover vital to investigate the gap between intended and actual fertility in order to understand and evaluate the effectiveness of the use of the measure of fertility intentions as a valid predictor for both fundamental demographic research, but also for policy analysis and population projections. The study of the mismatch between intended and realised fertility behaviour reflects a wider debate about the true predictive power of individuals' fertility intentions (e.g. Quesnel-Vallée & Morgan 2003, Berrington 2004; Toulemon & Testa 2005; Testa & Toulemon 2006). Recent studies reveal a persistent discrepancy between intended and actual fertility (see European Commission 2006; Testa 2006). Some gap is to be expected due to the fact that fertility intentions are highly contingent on, and subject to, revisions (Quesnel-Vallée & Morgan 2003). Yet to what extent can we consider a gap as physiological? It is particularly relevant to understand why a gap is bigger in some circumstances than in others, and for some groups of individuals compared to others, and under what conditions fertility intentions can be considered as an adequate and reliable predictor of actual behaviour.

By investigating which factors affect the realisation of fertility intentions and how they operate, we can gain insights on the forces that facilitate or inhibit the realisation of childbearing intentions. In recent years, increasing attention has been devoted to the analysis of potential factors (Quesnel-Vallée & Morgan 2003; Adsera 2005, both focussing on the intended overall number of children; Spéder & Kapitany 2009; REPRO project, work package 4, 2010, focus on time-dependent, parity-progression intentions). Three main forces appear to drive the mismatch between desired and actual fertility, namely: demographic (e.g. age, parity), socio-economic (e.g. education and employment status) and ideational (e.g. religion) aspects.

The aim of this study is to build upon and extend existing research by investigating a largely ignored fourth factor, which is the role of the family network and specifically: family social capital and intra-familial social interaction. Previous research on the intention-behaviour gap in fertility has focused on micro-level individual and macro-level institutional characteristics, which has been at the expense of recognising vital meso-level family networks. Following the literature on personal networks (Kohler et al. 2001; Bühler & Philipov 2005; Bernardi et al. 2007) and focussing in particular on the family, we can identify two primary and complementary roles of the family network in shaping an individual's fertility choices (Balbo & Mills 2011). The first one, which is the more stable aspect, is the family as a source of social capital. Family social capital, which we

operationalise as the strength and quality of family ties, may either facilitate or inhibit the realisation of fertility intentions. The second one, which can be considered as a more contingent force, is the family network as the locus of social interaction, where individuals engage in communication of expectations, learn and are influenced by others' behaviour (e.g. Montgomery & Casterline 1996; Bongaarts & Watkins 1996; Kohler 2001; Bernardi 2003). Following Axinn et al. (1994) and Lyngstad & Prskawetz (2010), we operationalise this aspect via sibling interactions and specifically test whether the presence of young children of a sibling impacts the realisation of fertility intentions. Our aim, therefore, is to empirically test whether family social capital and intra-familial social interaction may be another factor to explain the gap between intentions and behaviour.

This study focuses on time-dependent, parity-progression fertility intentions and more specifically, on the intention to have a(nother) child within three years, coupled with the realisation of this intention both for the transition to first and higher-order births. We focus on short-term intentions for both theoretical and practical reasons. Previous studies (Dommermuth et al. 2009; Philipov 2009) have shown that short-term intentions are more accurate than long-term ones, due to the fact that people are more capable of predicting their life situation within a shorter period of time. A second more practical reason is that we use a panel dataset in this study that follows individuals for a period of 3.5 years, which permits us to examine their intentions and then behavioural outcomes during this time span.

This study builds upon and contributes to the existing literature on the realisation of fertility intentions in three central ways. First, we introduce several potential theoretical mechanisms, such as Simon's (1956, 1957) classic theory of 'satisficing' to understand the underlying mechanisms of how family social capital and intra-familial interaction either inhibit or facilitate the realisation of first and higher-order births. Previous research has focused on the impact of social capital on fertility intentions (e.g. Bühler & Philipov 2005; Philipov et al. 2006), but not on the impact of the realisation of these intentions. Although already a few studies have examined the impact of cross-sibling effects or sibling interaction on fertility behaviour (Bernardi 2003), they have focused on the number of nieces and nephews in relation to the number of children (Axinn et al. 1994) or on an individual's fertility timing (Lyngstad & Prskawetz 2010) and not on the realisation of fertility intentions. A second related contribution is the fact that we focus not only on the realisation of fertility intentions in general, but our aim is to examine whether family social capital and sibling interaction operate differently for first versus higher-order births.

Our final contribution is of a methodological nature. Previous research examining the gap between fertility intentions and behaviour has often compared the intended and achieved family size, thereby focusing on the overall expected and the actual number of children (e.g. Noack & Østby 2001; Quesnel-Vallée & Morgan 2003; Adsera 2005). We are instead interested in investigating the realisation of parity progression intentions (which

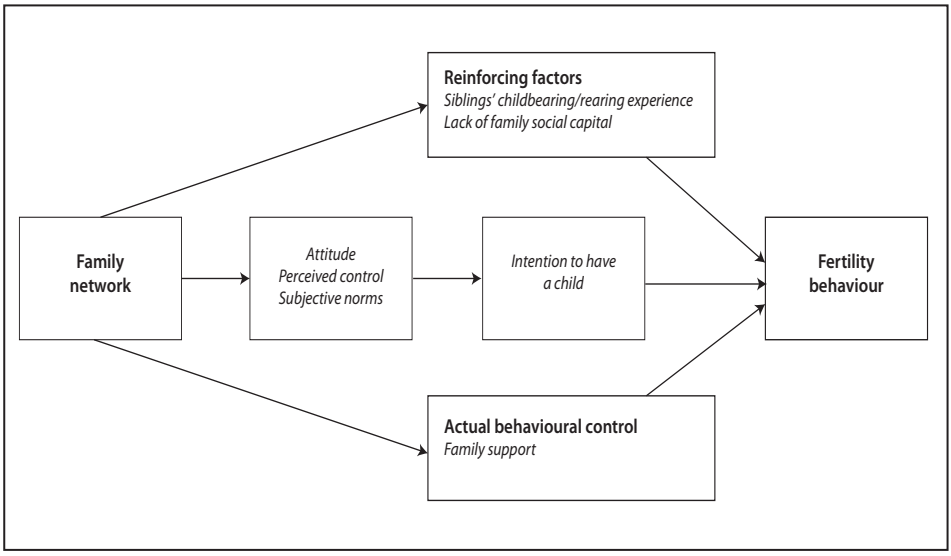
in our case are also time-dependent because we look at intentions to have a(nother) child within three years). Some studies that have also followed this latter approach have adopted the methodological strategy of using fertility intentions as one of the main covariates in the model predicting fertility behaviour (e.g. Berrington 2004, Toulemon & Testa 2005; Testa & Toulemon 2006). Although this approach is useful to test whether fertility intentions will predict subsequent behaviour, it does not allow the analysis of what factors facilitate or constrain an individual's positive intention to have a(nother) child. A handful of studies (Spéder & Kapitany 2009, REPRO project, work package 4, 2010) make use of multinomial regression models to compare those who realised the intention to have a child with those who postponed or abandoned their intention. However, when only individuals with positive fertility intentions are included in the model (Spéder & Kapitany in REPRO project, work package 4, 2010), the analyses may produce biased estimates. The current study takes a different approach by adopting a probit model with sample selection (Van de Ven & Van Praag 1981), which extends existing research by both avoiding the selection problem and also simultaneously empirically testing whether the inclusion of only samples with positive intentions produces biased estimates.

We first present our theoretical framework, which includes attention to the Theory of Planned Behaviour, family social capital and cross-sibling effects. This is followed by a description of the two waves of the Netherlands Kinship Panel Study (NKPS) data used in this study, the measurement of variables and our analytical approach of a probit model with sample selection. The results are then described in relation to our central theoretical expectations, followed by a conclusion and discussion.

4.2 Theoretical framework

Recent studies have theoretically and empirically linked the Theory of Planned Behaviour (TPB) (Ajzen 1991) to social network theories of fertility (Rossier & Bernardi 2009; Billari et al. 2009). Building upon these previous studies, we use the TPB as our starting point, and thus consider that having a child is a purposive or intentional behaviour (Figure 1). The TPB states that the intention to perform a specific behaviour is the result of the combination of three antecedents: (i) attitudes towards the behaviour in question (i.e. perceived cost and benefits); (ii) subjective norms about that behaviour (e.g. influence of relatives and peers); and, (iii) perceived control over behaviour (i.e. the extent to which behaviour is perceived to be subject to control). The TPB holds that background factors such as the family network are already inherent within the three antecedents of intentions. By assuming that fertility intentions are the proximate antecedent of behaviour, the TPB claims that factors which have an impact on intentions will also have an impact on behaviour, but not vice versa. Engaging in a behavioural outcome depends not only on a favourable intention but also on a sufficient level of actual behavioural control. This refers

Figure 1: Integrating the family network and the Theory of Planned Behaviour to predict fertility behaviour



to the extent to which a person has the skills, resources and other prerequisites required to enable them to enact the intended behaviour.

As Figure 1 demonstrates, our conceptual model extends the TPB framework by assuming that an individuals' immediate family network exerts influence not only on attitudes, perceived control and subjective norms, but also during the later phases of decision-making.[1] We anticipate that this effect strengthens when the time span between intentions and predicted behaviour is longer due to the fact that individuals are exposed to family influence for a longer period of time. Since reproductive behaviour is not routine behaviour, but a crucial life decision that involves certain prerequisites (e.g. having a partner), fertility intentions generally involve 'long-term' planning. We therefore argue that intra-family mechanisms can influence actual behavioural control and act as further reinforcing factors that influence fertility behaviour outcomes (see Figure 1). Besides institutional settings (e.g. family policy and availability of public child care) and individual demographic and socio-economic factors (e.g. income, education and employment status), we argue that the family context affects an individual's ability to control and realise fertility behaviour. An individual's family network might be seen as social capital, and therefore a source of stability, well-being and informal resources (e.g. information, economic, emotional and informal child care support, see Bühler & Philipov 2005).

1. Given that the focus of this study is on the link between intention and behaviour and not on the formation of the former, we were not directly interested in testing the effect of Ajzen's three antecedents on intentions. However, we would have nonetheless included them in the empirical model if adequate measures would have been in the data, which unfortunately was not the case.

We also anticipate that two additional family network mechanisms are at play. First, instead of only assuming that family social capital is a *source* of actual behavioural control, following Astone et al. (1999), we argue that having a child is primarily a form of *investment* in social capital. Having weak family ties might therefore reinforce already positive intentions to have a child, which then operates as a way to acquire new social capital. We acknowledge that this latter mechanism appears to contradict the one described above. However, since previous research has produced evidence for both mechanisms, the current study aims to test which explanation prevails and under what circumstances (see next paragraph for parity-specific hypotheses). Second, following Kohler's (2001) argumentation related to social interaction and diffusion theories, intra-family social interactions might influence and enhance fertility behaviour. The childbearing and childrearing experience of a sibling may reinforce already positive fertility intentions, leading to a higher likelihood of realising them. We now elaborate upon the two central family network effects and their relationship to fertility, which are: family social capital and intra-familial interaction.

4.3 Family social capital

According to Coleman (1988, p.384), "the social capital of the family is the relation between children and parents (and, when families include other members, relationships with them as well)". Astone and colleagues (1999) underline that the concept of social capital not only refers to the relationships themselves, but also to their quality and strength, as well as the resources available through those relationships. Social capital resources can include goods as well as knowledge, information, money, capacity to work, influence, power or active help (Bühler & Philipov 2005).

Recent demographic research has shown that social capital, next to economic and cultural resources, is an important factor for fertility decisions (e.g. Schoen et al. 1997; Bühler & Philipov 2005; Philipov et al. 2006). This body of research looks at supportive network relationships as strategies for coping with one's socio-economic circumstances in relation to fertility (e.g. assistance in child care). Since these studies have focussed on the role of social capital in the formation of fertility intentions only, our goal is to extend this body of research on social capital and fertility by investigating its role in relation to the realisation of fertility intentions.

The relationship between social capital and fertility is not a straightforward one. Previous research has presented a puzzle, since there is theoretical and empirical support for two competing hypotheses about how family social capital might operate to impact the realisation of fertility intentions. The first mechanism supposes that people who possess more social capital might feel more secure and supported, and are therefore more likely to realise their fertility intentions sooner. Studies of women in eastern European countries (e.g. Bulgaria and Poland: Bühler & Philipov 2005; Bühler & Fratzack 2007)

have shown that the availability of economic, instrumental and emotional support is certainly taken into account during fertility planning and that more supportive network resources positively influence both the timing (earlier births) and quantum (number of births) of fertility intentions. Based on these findings, we propose our first hypothesis on the realisation of short-term fertility intentions, which is:

H1a) the higher the level of family social capital, the higher the probability of realising the intention to have a(nother) child within three years.

This is due to the fact that high levels of family social capital aid in reducing uncertainty and also the costs related to childbearing.

However, there might be a second opposing mechanism at play for those with strong family ties, which is the fact that individuals are more likely to adopt a 'satisficing' strategy. Here we draw from Simon's (1956, 1957) classic theory of 'satisficing', which refers to the decision-making process where individuals opt for an adequate rather than an optimal solution in particular situations. Simon (1956, 1957) argues that individuals lack the cognitive resources often demanded by complex decision-making situations which entails that they are often uncertain about what constitutes a satisfactory outcome. In Simon's view, when deciding whether or not to have a child (or an additional child), individuals are unaware and unable to calculate the circumstances. This is attributed to the complex factors involved when making these decisions, but also to uncertainty about the future and, for those having a first child, to inexperience and inability to calculate the consequences. The individual is therefore only able to evaluate his or her fertility behaviour on the basis of the probability that it will be satisfactory, which is a 'satisficing' strategy. By choosing to realise their intention to have a(nother) child, individuals opt for an outcome that has the maximum probability of being satisfactory, which is close to optimisation under conditions of uncertainty (and therefore it might have changed from when the intention was formed).

We contend that individuals with high levels of family social capital would be likely to adopt a satisficing strategy since their strong family network is a near optimal solution for personal fulfilment and thus operates as an adequate replacement for one or additional children. These 'satisficed' individuals lack the urgency to invest in their family network and would therefore be less likely to realise their childbearing intentions within the planned time span. This leads us to a second, competing hypothesis:

H1b) the higher the level of family social capital, the lower the probability of realising the intention to have a(nother) child within three years.

To understand this process further, we can also turn to explanations developed by materialist anthropologists (e.g. Greenhalgh 1995), sociologists and demographers (e.g. South 1991; Astone et al. 1999). Here the central argument is that children do not deplete or necessitate social capital, but rather *generate* social capital by establishing new or better

relations among persons (parents, relatives and friends, from whom potentially drawing resources) and by guaranteeing more security for parents in their old age (Billari & Galasso 2008; Mills & Begall 2010). Building upon this body of research, we anticipate that those with weak family ties would be more willing to have a child to improve their own social capital (Schoen et al. 1997). In a recent study using Bulgarian data, Bühler (2008) demonstrated that children can operate to improve their own parent's social networks. Fertility intentions are influenced by the notion that a child will strengthen the relationship between parents and relatives and provide support in old age. This echoes the classic work of Hoffman & Hoffman (1973) where parents are seen as attributing a set of values to children such as the expansion of the self, affiliation, stimulation, accomplishment and social comparison. Zelizer (1994) likewise attests that the value of children has shifted from the role of economic contribution to the household to being a more sentimental criterion and operating as an extension of the emotional satisfaction and self-actualisation and thus personal social capital of their parents.

As outlined briefly in the introduction, we are also interested in exploring how (higher) social capital impacts the transition to the first birth, compared to higher-order births. The decision to have the first child is qualitatively different from having subsequent children, since the former marks a totally new transition into parenthood (Billari et al. 2009; Philipov et al. 2006; Schoen et al. 1999). We therefore adopt the assumption that the underlying drivers of first and higher-order births are different and will investigate whether family social capital dynamics might have different effects and intensities. Specifically, we anticipate that the two competing social capital mechanisms for those with higher levels of family social capital (Hypotheses 1a and 1b), will have stronger effects for higher-order births. If family ties are indeed a source of support, additional children will translate into the need for more supportive resources to counter the costs and uncertainty associated with having additional children. It may be that strong family relationships allow people to be satisfied and fulfilled with their existing social network and therefore less likely to invest in a big family (more than one child), whereas having the first child might be more of an answer to biological needs and social norms. Therefore, building on H1a and H1b, our second set of hypotheses predicts the following:

H2a) a higher level of family social capital has a stronger positive effect on the realisation of the intentions to have another child than on the realisation of the intentions to have the first child

H2b) a higher level of family social capital has a stronger negative effect on the realisation of the intentions to have another child than on the realisation of the intentions to have the first child

4.4 Intra-familial interaction: cross-sibling effects

There is increasing acknowledgement of the importance of informal social relationships and social interaction in influencing individual childbearing behaviour (Montgomery & Casterline 1996; Bernardi 2003; Bongaarts & Watkins 1996; Kohler 2001). An individual's fertility is not only influenced by individual characteristics but also by the features and behaviour of the people with whom the individual interacts. The rationale behind this perspective is that individuals, through social interactions, gain knowledge and information from others (social learning) and are influenced by others (social influence; Kohler 2001).

Following Axinn et al. (1994) and Lyngstad & Prskawetz (2010), in the present study, we focus on intra-family social interaction effects on fertility, and specifically on siblings' interactions. While past demographic research has considered siblings as an instrument to control for genetic or shared environmental effects (e.g. twin studies), in recent years the importance of siblings' effects on socio-demographic behaviours has been acknowledged by several authors (e.g. Hogan & Kitagawa 1985; Haurin & Mott 1990; Powers 2001). Indeed, siblings are a primary, strong and often stable component of an individual's personal network, since relationships among siblings are likely to be close and long-lasting throughout the life course. Siblings can act as role models (Haurin & Mott 1990), be a source of information on life course transitions (Bernardi 2003) or, through their behaviour, reinforce already existent family attitudes, values or influence (Axinn et al. 1994).

Very few studies have investigated the cross-sibling effects on reproductive behaviour in industrialised countries. Relevant exceptions include the qualitative work of Bernardi (2003) which highlights siblings' childbearing experience as a source of information, and two quantitative studies that make use of micro-data, namely those of Axinn et al. (1994) and Lyngstad & Prskawetz (2010). The former shows that the number of nieces and nephews is correlated with number of children; the latter investigates cross-sibling effects on an individual's fertility timing and rates. We aim to extend this literature by focusing on another fertility outcome: the realisation of fertility intentions.

Perhaps the strongest reason for the lack of research on this topic rests with the fact that social interaction effects are endogenous. Or, as Manski (1995) explains: "the behaviour of an individual varies with the distribution of behaviour in a group containing the individual. The interactions are endogenous because the outcome of each group member varies with the outcomes of the other group members, not with other attributes of the group". Put differently, the cross-sibling effects on fertility might not be due to 'imitation mechanisms', social pressure or information exchange but rather as a result of the effect of other unobservable family background factors (since family, in the case of siblings, is our 'reference group') on every sibling. Some authors have tried to solve this issue using new

model specifications (see Kravdal 2003), yet these solutions have been contested, with the appropriate method for estimating cross-sibling effects remaining open (Lyngstad 2008).

We fully acknowledge this issue, but still claim that it is important to take siblings' interactions into account, even though we opt to model them in an intuitive way. Since our data do not allow us to include any family-fixed effect or use a multilevel specification, we model cross-sibling effects by defining an individual's probability to realise his/her intention to have a child as a function of the past fertility behaviour of one or more siblings (i.e. the presence of a young nephew/niece). We concede that this straightforward model specification does not permit us to infer any pure causal effects of siblings' behaviour on respondent's fertility. However, by looking at siblings' fertility behaviour while controlling for observable family background characteristics, we can uncover whether there is any influence of the family network on an individual's actual realisation of the intention to have a child that works via intra-sibship mechanisms. We therefore assume that cross-sibling effects on fertility operate as both a signal of family attitudes and values that are reinforced by a sibling's behaviour and as a consequence of social learning and influence processes that stem from observing siblings as role models and as a source of information. Assuming that a cross-sibling effect might be relevant and observable only when the childbearing experience is recent or the nephew or niece is still a young child, we hypothesise that:

H3) Individuals who have siblings with a young child (under the age of 12) are more likely to realise their fertility intentions, all other things being equal.

4.5 Data, measurement and analytical method

Data and sample

We use data from Wave 1 (2002-2004) and 2 (2007) of the Netherlands Kinship Panel Study (NKPS), a large-scale survey of Dutch men and women aged 1879 at Wave 1 (Dykstra et al. 2005). The NKPS provides us with an exceptional opportunity to use detailed longitudinal information on intra-family relationships and solidarity. Moreover, it provides us with data not only regarding the nuclear family but also about the extended family, including parents, siblings, grandparents and other relatives. 8,156 respondents participated in Wave 1, resulting in a response rate of 45%. This is comparable to the rate of other large-scale surveys in the Netherlands (Dykstra et al. 2005), keeping in mind that response rates in the Netherlands are generally lower than in other countries (De Leeuw & De Heer 2001).

74% of the Wave 1 respondents also completed the questionnaire in Wave 2. Given an attrition rate of 26%, we carried out an attrition analysis on the sub-sample we selected for this study, using a probit to test whether the non-response pattern was random (the pseudo Rsquare, which can be considered a measure of the non-randomness, could only explain 4% of the attrition).

Results showed that males, singles and less educated individuals were more likely to drop out of the survey. Our results are very much in line with what has been found on the overall NKPS sample (Dykstra et al. 2007). Therefore, in preliminary analyses, we replicated our models using weighted data, provided by the NKPS. Since results were essentially the same as those with unweighted data, we preferred using the latter ones (following Rijken & Thomson 2011).

We selected a sub-sample (N=3,270) of men and women aged between 18 and 45 years-old, with or without children, but not expecting a child at Wave 1. Within this sample, 1,090 people declared that they intended to have a child within three years in the first wave. We decided not to restrict our analysis only to respondents with a coresidential partner since we are interested in the evolution of fertility intentions over a longer time span of 3.5 years. Therefore, we believe that it is reasonable and realistic that people can find a partner and have a child within such a spell (see Table 1 for an overview of the characteristics of the sample).

Measurement of variables

Dependent variable: realisation of fertility intentions. Our dependent variable is the likelihood of realising the intention to have a child within three years. We computed this dependent variable using three questions from both waves of the survey: i) whether the respondent intended to have a(nother) child (*Do you think you will have (more) children in the future?*), ii) within how many years he/she intended to have a baby at the time of the first wave (*Within how many years' time would you like to have your first/next child?*); and, iii) whether the respondent had a child between the two waves or was pregnant at the time of the second wave (*Have you and your/this partner had a child together since the last interview?*) Using the first two questions, we identified those who had positive fertility intentions at Wave 1. We also made use of these questions to compute the fertility intentions variable included in the probit with sample selection. We opted to focus on the intentions to have a child within three years because the time span between the two waves was 3.5 years. For this group of people we computed a dummy variable that takes on the value 1 for individuals who had a child. We address the issue of how we controlled for potential selection bias in the last section that describes our analytical methods.

Independent variables

Family social capital is operationalised to measure the strength and quality of family ties. By first engaging in a factor analysis, we computed an index using the following items: *1) the ties between members of my extended family are tightly knit, 2) my extended family is more a collection of individuals rather than a single unit, 3) in our extended family we keep each other informed about the most important events, 4) the members of my extended family are very close*, 5) *when I am troubled, I can always discuss my worries with my family, 6) I*

place confidence in my family, 7) should I need help, I can always turn to my family, 8) I can always count on my family. Possible answers are on a 5point scale ranging from 1, *strongly agree*, to 5, *strongly disagree* (Cronbach's alpha=0.91). In order to test for a potential curvilinear effect of family social capital on the realisation of intentions, we also computed and included the squared index in the analysis.

The NKPS provides us with general demographic characteristics about each of the respondent's (biological, adopted, half) siblings; however, information about solidarity, partner and parental status are collected only for two randomly selected siblings, therefore our explanatory variable inevitably refers to these two siblings only. Even though this approach does not allow us to have full knowledge of the childbearing experience of all of the respondent's brothers and sisters, the random selection process through which the two siblings are chosen ensures against any selection bias. Indeed, if the two siblings would have been selected by the respondent, results might have been biased by the non-random selection of the sibling relationship.

Presence of siblings' children under the age of 12 was measured by creating a dummy variable that indicated whether at least one sibling had a child under the age of 12. It was only possible to derive this information from Wave 2 where the respondent was asked if the two randomly selected siblings had children under the age of 12 and additional questions which allowed us to determine if siblings had a child between the two waves. Since we unfortunately cannot determine when the siblings' children were born, but we want to ensure that these children were born before the respondent's child (which would be between Wave 1 and 2), we exclude those cases in which we know that the sibling has a child under 12, but the sibling gave birth to his/her first child between the two waves. This is due to the fact that we cannot determine if this occurred before or after the respondent's own childbearing.

Control variables

In order to avoid a spurious association between family network and fertility outcomes, we included several control variables in our models. The selection of the control variables is guided by findings from previous studies on this topic, specifically by Spéder & Kapitany (2009; REPRO project, work package 4, 2010), that have highlighted the importance of socio-demographic factors in the process of realizing fertility intentions. Namely, we include: age, age squared (to control for a curvilinear effect of age), education (respondent's highest educational attainment is measured on a scale ranging from 1—primary school not finished, to 10—postdoctoral degree),[2] partnership status (a categorical variable with

2. The exact question with its scale is the following: What is the highest level of education that you completed with a diploma? 1. Did not complete elementary school, 2. elementary school only, 3. lower vocational, 4. lower general secondary, 5. intermediate general secondary, 6. upper general secondary, 7. intermediate vocational, 8. higher vocational, 9. University, 10. post-graduate.

three categories: single, cohabiting or married at Wave 1) and parity (a scale measured at Wave 1 which is included in the models that analyse higher-order births). In previous analyses we also included a measure of religiosity in order to partially account for ideational factors (Spéder & Kapitany 2009), but since it was not significant, we opted to exclude it from the model.

In order to disentangle the role of intra-family social interactions and social capital from family background factors, we control for family and parents' characteristics that have been shown to be relevant for children's fertility behaviour (Axinn et al. 1994; Rijken & Liefbroer 2009). Specifically, after having considered several family factors (e.g. parental religiosity and parental disruption), we have included only those that have been shown to be significant in at least one of our models. These are the mother's and father's education (scale variables identical to the respondent's education measure) and the number of siblings (biological, half and adopted), which is a scale variable that allows us to control for the parents' fertility attitudes and behaviour. Finally, in the models where we test cross-sibling effects (Model 3 and 4), we controlled for the age differences among the respondents and each of the two randomly-selected siblings in addition to the siblings' sex.

Analytical method

As highlighted in the introduction to this study, previous studies have only included those individuals in the analysis who have positive fertility intentions, which may result in potentially biased results. In order to control for the potential selection bias that would arise from looking only at individuals with positive fertility intentions, we opted for a probit model with sample selection (Van de Ven & Van Praag 1981). This entailed analysing a binary outcome (i.e. having a child or not) that is observed only for a specific part of a sample (i.e. those who already had positive fertility intentions at Wave 1). The assumption that unobserved factors affecting selection into that sample (i.e. the intention to have a child within three years) may simultaneously affect our binary outcome of interest (i.e. realisation of that intention) led us to use the Heckman sample selection model (1979), but in its specification for a binary outcome (Van De Ven & Van Praag 1981. See Appendix for a detailed description of the model).

We implemented probit with sample selection in the software STATA, which estimates the model using maximum likelihood (Billari & Borgoni 2005). In this way, the model is identified on the basis of distributional assumptions and therefore an exclusion restriction[3] is not required. However, it has been demonstrated that with at least one exclusion restriction (Sartori 2003), the Heckman procedure performs better. Therefore, following

3. A two-step procedure, in order to be identified, requires that at least one variable that is in the selection equation is be not $contained in the outcome variable. Put in another way, we should find a variable that affects the formation of the intentions but not its realisation.

the strategy applied by Philipov et al. (2006), we first estimate the two probit equations separately, without considering sample selection, in order to look for a valid exclusion restriction. During these analyses, we did find that gender has a significant effect on fertility intentions but not on behaviour. This seems rather logical from a theoretical point of view as well. While the extent to which men and women intend to have a child may differ due to the fact that the formation of intentions takes place more at the individual level, the actual realisation of these intentions occurs at the level of the couple and should therefore be the same for both sexes. We therefore treat gender as our exclusion restriction and include it only in the selection equation (i.e. probit on intentions).

As mentioned previously, we are interested in exploring whether and how family social capital mechanisms work differently for the first child compared to higher-order births. As a consequence, we run separate models for childless people (N=1540) and for those who already have at least one child (N=1730). We restrict the analysis of possible cross-sibling effects to people with at least one sibling and with no children at Wave 1 (N=690). We exclude individuals who already have children for a practical reason. Since we do not have any information about when their siblings' children were born, we cannot know whether respondents who already have children at Wave 1 gave birth before or after their siblings. Since we are interested in the possible effect that siblings' fertility behaviour has on the respondent's fertility, we overcome this issue by only studying cross-sibling effects on childless people at Wave 1. It is relevant to note that previous research (Lyngstad & Prskawetz 2010) has shown that cross-sibling effects are almost negligible for higher-order births.

We also divided this sub-sample of childless people with at least one sibling into two further groups and ran separate analyses for those who only have one sibling (N=340) and those who have two or more (N=350). This decision was motivated by two central reasons. First, a family with only two children (i.e. respondent plus one sibling) might have substantially different background characteristics and preferences (which in turn could influence the fertility preferences of the children) compared to a larger family (i.e. more than two children/siblings). Having two children may be more normative and 'standard', while bigger families might have more selective characteristics. Therefore, since the data do not permit us to control for a family-fixed effect, we opted for dividing the sample into two more likely homogeneous groups and running separate analyses. Second, by putting together those with only one sibling and those who have more than one, we could not have controlled for the age difference between the respondent and each sibling and the sex of each sibling, as the age difference with the second sibling and his/her sex is missing for all those with only one sibling. We believe that this strategy allows us to better control for potential observable and unobservable family factors that could influence the realisation of an individual's fertility intentions.

Table 1: Descriptive characteristics of the sample (in %)

	Entire sample		Sample with positive fertility intentions	
	Childless	With children	Childless	With children
	1540	1730	794	296
Intention to have a child within 3 years			-	-
Yes	49.6	17.1	-	-
No	50.4	82.9	-	-
Had a child				
Yes	16.0	14.0	23.8	42.3
No	84.0	86.0	76.2	57.7
Gender				
Men	47.6	33.1	48.7	32.8
Women	52.4	66.9	51.3	67.2
Partnership status				
Single	62.1	13.0	59.8	9.2
Cohabiting	24.1	12.8	28.7	21.1
Married	13.8	74.3	11.5	69.7
Nephew/niece under 12				
No	78.7	60.0	81.1	55.3
Yes	21.3	40.0	18.3	44.7
Gender of sibling 1				
Male	51.6	53.1	51.9	48.3
Female	48.4	46.9	48.1	51.7
Gender of sibling 2				
Male	50.9	52.3	51.8	57.7
Female	49.1	47.7	48.2	42.3

N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Standardised Age	0	1	0	1	0	1	0	1
Education (1-10)	6.6	2.0	6.2	2.1	6.7	1.9	6.7	1.9
Mother's education (1-10)	4.6	2.2	3.6	1.9	4.9	2.2	4.0	2.1
Father's education (1-10)	5.4	2.6	4.5	2.5	5.6	2.6	4.9	2.5
Number of siblings	2.0	1.6	2.7	2.1	1.8	1.4	2.3	2.1
Parity	-	-	2.0	0.9	-	-	1.3	0.6
Age difference with sibling 1	1.0	5.1	1.2	5.9	0.8	4.9	0.8	4.8
Age difference with sibling 2	-0.2	6.6	0.0	7.1	-0.1	6.6	-0.7	6.8
Family social capital	-0.1	0.9	0.0	0.9	-0.2	0.9	-0.2	0.9

4.6 Results

The results of our probit with sample selection models are shown in Tables 2 and 3. Table 2 shows results regarding the effect of family social capital on fertility. In this table, two models are reported. Model 1 contains estimates for the first child (i.e. childless people) and Model 2 shows the estimates for higher-order births (i.e. people who already have children). Table 3 reports the findings for intra-familial cross-sibling effects. Once again there are also two models: Model 3 includes only respondents with one sibling, while Model 4 refers to respondents who have at least two siblings. For each model, the outcome equation is

reported in the first or top half of the table, which is the probit likelihood of the realisation of positive intentions. Below this, the bottom panel of the table contains the estimate from the selection equation, which is the probit likelihood of the intention to have a child within three years.

Empirically testing sample selection bias

The first finding that we should note is that in all models in both tables, the correlation coefficient for the residual component (i.e. rho) of the two equations is positive but never significant. From a behavioural point of view, this means that, although there are probably some unobserved characteristics which positively affect individuals' fertility intentions *and* their behaviour, this effect does not seem to play a significant role.

The test on rho suggests that we cannot reject the null hypothesis that rho is equal to zero, or in other words, that the correlation is not significant. Standard probit models of the realisation of positive fertility intentions could therefore have also provided us with unbiased estimates. We acknowledge, however, that our samples are small, which might lead to a low level of statistical power, thereby increasing the probability of a TypeII error (failing to reject the null hypothesis that rho is not different from zero, i.e. that the correlation is not significant). Because of this, and taking into account that preliminary analyses showed that standard probit models overestimate the effect of age (in all of the models) and parity (in Model 2) compared to the estimates of the probit with sample selection models, we opted to control for the small positive selection bias and estimated a probit with sample selection. Moreover, this model allows us to undertake an interesting comparison between factors affecting the formation of fertility intentions and those impacting on their realisation.

Family social capital

Turning first to the results of family social capital in Table 2, it should be recalled that initially we posed two competing hypotheses where we predicted higher levels of family social capital to result in either a higher (H1a) or lower probability of realising one's fertility intentions (H1b). The results show that strong and supportive family ties do not significantly increase the actual behavioural control of an individual and enable him or her to be more secure and thus have a higher propensity to realise his/her intention to have a child. This implies that H1a is not supported by the data. Instead, we rather found some support for H1b, since we observed a negative association between social capital and the realisation of fertility intentions. We did not find any curvilinear effect of family social capital on fertility behaviour, since the squared term is not significant. In order to check the robustness of these findings we ran preliminary analyses using a categorical variable with three categories (low, medium, high family social capital, computed from the factor) and did find consistent results. It appears that when an individual possesses high family

Table 2: Probit with sample selection estimates of the realisation of intentions (outcome equation) and fertility intentions (selection equation)

	Model 1: childless		Model 2: with children	
Realisation of fertility intention				
Constant	0.1026	(0.7363)	-0.8506	(0.5867)
Age	0.1706	(0.3291)	-0.5245	(0.3117)
Age squared	-0.2388	(0.1573)	-0.1239	(0.0803)
Partnership status (ref: married)				
Single	-1.5113***	(0.2068)	-1.2304***	(0.3315)
Cohabiting	-0.5447**	(0.1979)	-0.1160	(0.1835)
Education[a]	0.0320	(0.0360)	0.1185*	(0.0594)
Parity[b]	-		-0.5394	(0.4115)
Mother's education[a]	0.0274	(0.0325)	0.0344	(0.0452)
Father's education[a]	-0.0472	(0.0252)	0.0138	(0.0351)
Number of siblings	0.0312	(0.0612)	0.0511	(0.0395)
Family social capital	-0.0444	(0.0734)	-0.1795*	(0.0899)
Family social capital squared	0.0280	(0.0440)	-0.0437	(0.0759)
N	794		296	
Fertility intention				
Constant	0.1600	(0.1945)	-0.3048	(0.2480)
Women	-0.2046**	(0.0709)	-0.1788*	(0.0990)
Age	-0.5821***	(0.0436)	-0.8436***	(0.0767)
Age squared	-0.2331***	(0.0415)	-0.1421***	(0.0418)
Partnership status (ref: married)				
Single	-0.1524	(0.1085)	-0.3819*	(0.1511)
Cohabiting	0.1012	(0.1185)	-0.0901	(0.1293)
Education[a]	0.0355	(0.0211)	0.1508***	(0.0286)
Parity[b]	-		-1.0025***	(0.0792)
Mother's education[a]	0.0302	(0.0190)	-0.0155	(0.0272)
Father's education[a]	-0.0092	(0.0161)	0.0135	(0.0217)
Number of siblings	-0.0751**	(0.0244)	0.0543*	(0.0242)
Family social capital	-0.0958*	(0.0427)	-0.0973	(0.0549)
Family social capital squared	0.0367	(0.0280)	-0.0530	(0.0390)
N	1540		1730	
Log likelihood	-1228.0526		-661.5771	
Rho	0.2699		0.5576	
LR test of independent equations (rho = 0):	Chi-squared(1)=0.12 P-value=0.7242		Chi-squared(1)=0.64 P-value = 0.4250	

Notes: Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001; a= scale: 1-10, b= scale variable
Source: NKPS, wave 1 and 2 (2002-2003, 2007). Calculations by the authors.

capital and at least one child, he/she appears to be socially fulfilled or satisfied with this position and opts for an adequate satisficing solution (i.e. adoption of a 'satisficing' strategy). In this sense, high levels of family social capital appear to deter from having a child.

This finding also relates to our second set of hypotheses, which are extensions of H1a and H1b to include a parity argument, where we anticipated a higher level of family

social capital to have either a stronger positive (H2a) or negative (H2b) effect on fertility realisation for higher-order parities, compared to the realisation of intentions to have a first child. Although we did not find any effect of the strength and quality of family ties on the realisation of *first* child fertility intentions (Model 1), there is indeed a significant effect for higher-order births (Model 2) and thus evidence to support H2b. In other words, higher levels of family social capital translate into a lower likelihood of realising the intention to have *another* child.

Turning to the bottom panel of Table 2, where we examine fertility intentions (and not the realisation of these intentions), we observe, once again, a negative association between an increase in the level of social capital and, this time, the intention to have the first child. We do not find the same effect for additional fertility intentions.[4] This is likely to be related to the point discussed above regarding the distinct nature of first versus higher-order births. This latter finding, which has a rather small effect, might be explained by the fact that individuals who experience a low level of family social capital may feel unsatisfied and therefore may realise their intention to have a child within the planned time span because they want and need to invest in their social capital.

Intra-familial interaction: cross-sibling effects

Table 3 reports estimates of the results of cross-sibling effects. Here our central hypothesis was that individuals who have siblings with a young child (under the age of 12) would be more likely to realise their fertility intentions (H3). When we examine both those with one (Model 3) and two or more siblings (Model 4), we observe that having a sibling with a young child is associated with a higher probability of realising one's own intention to have a first child. We therefore find support for H3.

Looking at cross-sibling effects on fertility intentions at the bottom panel of Table 3, we see a lack of any significant effects. This result is quite surprising as we had expected to also find a positive effect on the intention to have a child, which would have operated via the role of subjective norms. This finding might be explained by the fact that some family values are incorporated into the intention, which may not be captured by the siblings' behaviour. Rather, the childbearing and childrearing experience of a sibling might enhance an individual's actual behaviour, via a learning process, and therefore positively influence the likelihood of realising positive fertility intentions.

In order to improve understanding of how cross-sibling effects operate on fertility, we also included interactions between the age difference among siblings and the dummy

4. According to the TPB, those elements that constitute the perceived behavioural control might also turn into actual behavioural control (in Ajzen's original scheme there is an arrow going from the former to the latter). We can, therefore, hypothesise that family social capital might affect both fertility intentions as well as behaviour. However, in both cases, family social capital does not seem to operate as a source of control, but rather as part of an individual's 'satisficing' strategy.

Table 3: Probit with sample selection of the realisation of intentions (outcome equation) and fertility intentions (selection equation), childless individuals only (i.e. first-birth intentions)

	Model 3: 1 sibling		Model 4: 2 or more siblings	
Realisation of fertility intention				
Constant	-0.3471	(0.6157)	-0.0341	(0.7732)
Age	0.2472	(0.2599)	0.2617	(0.3555)
Age squared	-0.3894*	(0.1916)	-0.1756	(0.2077)
Partnership status (ref: married)				
Single	-1.4167***	(0.2810)	-1.8322***	(0.2562)
Cohabiting	-0.2529	(0.2522)	-0.8146**	(0.2721)
Education[a]	0.0215	(0.0592)	0.0516	(0.0522)
Mother's education[a]	-0.0121	(0.0522)	0.1187*	(0.0534)
Father's education[a]	0.0039	(0.0402)	-0.1229**	(0.0446)
Number of siblings			0.0974	(0.0732)
Age difference with sibling 1	0.0126	(0.0265)	0.0203	(0.0209)
Age difference with sibling 2	-		-0.0048	(0.0188)
Gender sibling 1 (ref.: male)	0.2040	(0.1823)	-0.1951	(0.1856)
Gender sibling 2 (ref.: male)	-		-0.0861	(0.1856)
Presence of a sibling' child	0.6382**	(0.2296)	0.4693*	(0.1974)
N	340		350	
Fertility intention				
Constant	0.6944*	(0.3342)	0.2014	(0.2860)
Gender (ref: Men)	-0.2966**	(0.1146)	-0.1299*	(0.0026)
Age	-0.5524***	(0.0718)	-0.5993***	(0.0613)
Age squared	-0.2904***	(0.0650)	-0.2428***	(0.0626)
Partnership status (ref: married)				
Single	-0.4087*	(0.1986)	-0.0095	(0.1471)
Cohabiting	-0.1872	(0.2112)	0.1902	(0.1657)
Education[a]	0.0151	(0.0353)	0.0164	(0.0281)
Mother's education[a]	0.0483	(0.0307)	0.0231	(0.0275)
Father's education[a]	-0.0176	(0.0261)	-0.0020	(0.0230)
Number of siblings	-		-0.0770*	(0.0338)
Age difference with sibling 1	-0.0092	(0.0158)	-0.0150	(0.0109)
Age difference with sibling 2	-		0.0176	(0.0094)
Gender sibling 1	-0.0876	(0.1135)	-0.0565	(0.0990)
Gender sibling 2	-		0.0461	(0.0999)
Presence of a sibling's child	0.0734	(0.1568)	-0.0037	(0.1153)
N	594		770	
Log likelihood	-461.7332		-564.4799	
Rho	0.4223		0.0094	
LR test of independent equations (rho = 0):	Chi-squared(1)=0.34 P-value= 0.5571		Chi-squared(1)=0.00 P-value= 0.9910	

Notes: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; a= scale: 1-10

Source: NKPS, wave 1 and 2 (2002-2003, 2007). Calculations by the authors.

indicating the presence of a nephew/niece and between the gender of the sibling and the presence of a nephew/niece. However, none of the interactions proved to be significant, therefore they were not included in our final models. Although this lack of significance could be attributed to the small sample size, it might also be that intra-sibship mechanisms do not have different intensities in relation to the sex or age (older or younger) of siblings.

Control variables

Finally, turning to the control variables, we see that socio-demographic factors act as expected and generally in line with previous findings (Spéder & Kapitany 2009). As previously mentioned, we have identified gender as our exclusion restriction. Indeed, in previous analysis using independent standard probit for fertility intentions and their realisation, we could not find any significant gender difference in the latter process but we did observe that women are significantly less likely to intend to have a child than men, which has also been demonstrated in previous research (e.g. Mills & Begall 2010).

Age does not seem to have any effect on the realisation of fertility intentions, which appear to be negatively influenced by any marginal increase in age (and the relationship is curvilinear). People who do not have a partner at Wave 1 (i.e. singles) are (of course) less likely to realise their intention to have a child, at all parities. Obviously, this effect is much stronger on the realisation of the intention, since a partner is an essential prerequisite, than on its formation. Moreover, those without children (Models 1 and 4) seem to be less likely to realise their fertility intentions when they cohabit, as opposed to being married. A higher level of education is associated with a higher probability to intend as well as to realise the intention to have *another* child (Model 2). We expect that this positive effect of education can be explained as an income effect (Kreyenfeld 2001).

In analysing the realisation of the intention to have *another* child, we controlled for the number of previous children (i.e. parity). Model 2 shows no significant effect of parity on fertility outcomes, but the higher the parity, the lower the likelihood to intend to have another child. Therefore, the number of children mainly affects the *intentions* to have another child, more than the actual behaviour. As for family background characteristics, we find a significant effect of parents' education only on the realisation of the intention to have a child for those people who are childless but have more than one sibling (Model 4). It is interesting to note that these variables only play a role for this specific sub-sample of people who come from a large family of origin. Since parental education operates as a proxy for family resources and values, the fact that mother's and father's education has an effect on the fertility behaviour of this group of people is not surprising. In a large family, resources might be particularly relevant since they need to be distributed across more individuals. Next to that, family values may be reinforced by intra-sibship behaviours. What we specifically observe is a positive effect of mother's education and a negative effect of father's education on the realisation of the intention to have a *first* child.

In preliminary analyses, we also computed a categorical variable with three educational levels to check for a possible non-linear effect, but we did not find any. Some authors (e.g. Knijn & Liefbroer 2006) have argued that parents with higher education or income give children more resources, thus facilitating children's family formation. Other studies (Murphy & Wang 2001) have demonstrated that parents' higher education has a negative effect on children's fertility behaviour, because life goals other than family formation are transmitted. We finally find that the number of siblings only affects fertility intentions but not behaviour. While Model 1 and 4 show that a higher number of siblings are associated with a lower probability of realising the intention to have the *first* child, having more brothers and sisters seems instead to have a positive effect on the intention to have *another* child (Model 2). The first effect seems to be consistent with the negative role played on the intention to have the *first* child by a higher level of family social capital (a tight-knit or large family might make individuals socially fulfilled and inhibit them from investing in their own family social capital by having a child). The second positive effect might be the result of the influence of parents' fertility preferences and behaviour (for a large family) on the child's reproductive behaviour, who also aims to have a large family.

4.7 Conclusion

The aim of this study was to both build upon and extend existing research on the intention-behaviour gap by investigating the importance of the role of the family network on the realisation of time-dependent fertility intentions for the first and higher-order children. Building upon previous research (Rossier & Bernardi 2009; Billari et al. 2009), we integrated family network mechanisms into the conceptual framework of the Theory of Planned Behaviour (Ajzen 1991), showing how intra-family dynamics can affect the end outcome of the fertility decision-making. We specifically looked at the family network as family social capital, and as a place where relevant social interactions occur, by focussing on cross-sibling effects. We posed two competing hypotheses regarding the impact of high levels of family social capital on the realisation of fertility intentions, explored how these vary by parity and examined cross-sibling effects. Building upon previous research (Spéder & Kapitany 2009, REPRO project, work package 4, 2010), we were specifically interested in investigating factors facilitating or inhibiting the intention to have a(nother) child within three years. We therefore addressed the problem of selection bias stemming from only studying those who have positive fertility intentions by estimating a probit model with sample selection. This enabled us to check and control for a potential selection bias, which was shown to be present, but at a negligible level.

Our findings demonstrated that strong family ties and high levels of family social capital are associated with a lower probability to realise the intention to have a child, for those who have at least one child. As Schoen et al. (1997) maintain, having a child can be seen as a social investment by future parents. Applying the classic theory of Herbert Simon (1956;

1957), we argued that individuals are often unable to make the complex calculations required to understand how a child or additional child might influence their lives, also considering uncertainty and inexperience with the situation. Individuals therefore adopt a 'satisficing' strategy and opt for an adequate rather than their originally planned optimal solution. By extension, people who already have very satisfying family ties and a strong family network lack the motivation to enact their positive fertility intentions and are more likely to adopt a 'satisficing' approach.

While the sociological and demographic literature has usually highlighted the positive influence of the personal network on fertility behaviour as a relevant source of supportive resources (i.e. social capital, Bühler & Philipov 2005) and social pressure (Balbo & Mills 2011), we instead observed that a strong and pervasive role of the family of origin might actually discourage the realisation of the intention to have further children. This apparent inconsistency is likely to be the result of the interaction between the family's role and the macro institutional and cultural context. Following Balbo & Mills (2011), we contend that in contexts where public child care is scarce and the economic situation is uncertain, having greater family social capital might work as an incentive to realise an individual's plan to have another child. Conversely, in more certain economic circumstances and environments where support from the state is relevant, strong family ties might be unnecessary or even discourage fertility.

The results also revealed significant cross-sibling effects on the intention to have the first child. In line with recent finding of Lyngstad & Prskawetz (2010), we demonstrated that when a sibling has a young child under the age of 12, the individual is more likely to realise his/her intention to have a child. This suggests that a recent sibling's childbearing experience or an ongoing childrearing experience with a young child seems to facilitate the translation into behaviour of an individual's positive fertility intentions. This effect is most likely attributed to different underlying mechanisms. First, the parental experience of a sibling could reinforce and intensify the transmission of positive parental values and attitudes towards childbearing. Moreover, since the transition to parenthood might bring uncertainty, having the opportunity to observe intimate members of one's network (e.g. siblings) experiencing this pivotal life event and learning from them, may reduce the degree of uncertainty and increase the actual behavioural control of an individual. We can therefore conclude that family settings in which the individual is surrounded by childbearing experiences of intimate others, affords them the opportunity to share information and feelings, which in turn facilitates the translation of their positive fertility intention into behaviour.

In our attempt to shed further light on the family network mechanisms influencing fertility behaviour, we also faced some constraints. First, our findings are based on relatively small samples, therefore further replications would be desirable to check the robustness of these findings. Second, in estimating cross-sibling effects on fertility

we could not control for possible unobservable family factors affecting every sibling. Indeed, the data used in this study did not allow us to include family fixed effects or use a multilevel approach, which would have helped us to disentangle the direct influence of siblings' childbearing behaviour from other possible intra-family factors. Moreover, the lack of information on the exact timing of respondents' and siblings' childbearing, did not allow us to undertake a dynamic analysis using event history models. Finally, we measured cross-sibling effects based on the information of two randomly-selected siblings only, without having a comprehensive knowledge of the entire sibship. Although we are aware of the data constraints we faced, and that existing datasets usually do not have extensive information on social interactions and networks, we believe that it would be important to further investigate family influences, as well as peer ones. We need not neglect the fact that people and couples do not make their fertility choices in a vacuum, but embedded in family and peer networks. We therefore hope that future research will be able to make use of more extensive network data which would allow us to overcome these issues and gain further insights into social influence and learning processes among siblings and relatives, as well as among friends. Finally, it would highly desirable that cross-national data are used to further test and replicate our findings in a comparative perspective.

Appendix A

The probit sample selection model consists of two probit equations in which Y_1 and Y_2 are the two dependent binary variables. Y_1, the choice that is studied, is observable only if Y_2 =1, where Y_2 is a preliminary choice. Looking at binary outcomes in terms of propensity, we assume that Y^*_2 is an unobservable outcome (i.e. the propensity of an individual to have positive fertility intentions), and Y_2 =1 only if $Y^*_2 \geq 0$, with Y_2 =0 if $Y^*_2 < 0$. If Y_2=1, individuals are faced with the studied choice, Y_1. Let Y^*_1 be the latent propensity random variable attached to the second binary choice (the realisation of the positive intention), so that Y_1=1 if $Y^*_1 \geq 0$, with Y_1 =0 if $Y^*_1 < 0$. To explain latent propensities, we can introduce two sets of predictors, X_1 and X_2, and define a two-equation system. The first equation describes the probability of having positive fertility intentions (i.e. the selecting event):

$$\text{Probit}\,(Y_2 = 1 \mid X_2) = X_2\,\beta$$

The second equation is defined only if Y_2 =1, and it describes the probability to actually realise the positive intention (i.e. outcome event):

$$\text{Probit}\,(Y_1 = 1 \mid X_1) = X_1\,\delta$$

In the same way, the system can be expressed linearly in terms of the unobservable propensities. The first equation describes the propensity to have positive fertility intentions:

$$Y^*_2 = X_2\,\beta + \varepsilon_2$$

The second equation, defined only if $Y^*_2 \geq 0$, describes the propensity toward the realisation of the intention:

$$Y^*_1 = X_1\,\delta + \varepsilon_1$$

Where β and δ are vectors of unknown regression parameters and $(\varepsilon_1, \varepsilon_2)$ is a zero-mean unit-variance bivariate normal random variable with corr $(\varepsilon_1, \varepsilon_2) = \rho$. As the two processes in question (i.e. developing a fertility intention and realising it) are made by the same individual and probably under similar circumstances, the two latent variables are likely to be correlated and the selection might not be neglected (i.e. ρ might be significantly different from zero). Therefore, estimating an equation for Y_1, an individual's probability to realise his/her positive fertility intentions, without taking into account the selection equation (i.e. the unobserved factors that affect the probability to have positive fertility intentions), might cause biased results of the parameters (Van De Ven & Van Praag 1981; Vella 1998).

5 Does fertility behavior spread among friends?

This paper investigates how social interactions among friends shape fertility. We specifically examine whether and how friends' fertility behavior affects an individual's transition to parenthood. By integrating insights from economic and sociological theories, we elaborate on the mechanisms via which interactions among friends might affect an individual's risk of becoming a parent. By exploiting the survey design of the Add Health data, we follow a strategy that allows us to properly identify interaction effects and distinguish them from selection and contextual effects. We engage in a series of discrete time event history models with random effect at the dyadic level. Results show that, net of confounding effects, a friend's childbearing increases an individual's risk of becoming a parent. We find a short-term, curvilinear effect: an individual's risk of childbearing starts increasing after a friend's childbearing, it reaches its peak around two years later, and then decreases.

This chapter is based on:

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5.1 Introduction

Several fertility studies have highlighted the importance of diffusion and social interaction processes for childbearing behavior (Bongaarts & Watkins 1996; Montgomery & Casterline 1996). Looking at human beings as social actors who make decisions and act while embedded in a web of social relationships with kin and peers, demographers have increasingly acknowledged the role of interpersonal interactions in shaping fertility decision-making (Kohler 2001; Bernardi, 2003).

At the macro level, researchers have often turned to diffusion and social interaction theories to explain fertility differentials across time and place (Bongaarts & Watkins, 1996; Montgomery & Casterline 1996; Kohler et al., 2002, 2006). Persistent diversity of fertility behavior between countries, regions or over time might be due to social interaction effects that amplify the behavioral impact of certain socio-economic and institutional changes (i.e., *social multiplier effects*) or maintain long-term behavioral differences across areas (i.e., *multiple equilibria* and *path dependence* (Billari, 2004)). However, the acknowledgment of the importance of social interaction in explaining observed fertility patterns has not been coupled with a satisfactory body of empirical research at the micro level. The main reasons are a lack of suitable data and the difficulty to model and properly identify social interaction effects (Manski, 1993, 1995). The existing meagre research on the effect of social networks on fertility is based primarily on data from developing countries and mostly investigates the use of contraception (Behrman et al, 2002; Kohler et al., 2001). Only a small number of studies focus on advanced societies, consisting mainly of small-scale qualitative work (e.g., Bernardi 2003; Bernardi et al., 2007; Keim et al., 2009). However, there have recently been signals of a growing interest in a more rigorous quantitative approach. A few studies engaged in quantitative analyses show that social interactions among siblings (Kuziemko, 2006; Lyngstad & Prskawetz, 2010), co-workers (Hensvik & Nilsson, 2010; Ciliberto et al., 2010) and peers belonging to the same ethnic-religious group (Manski & Mayshar, 2003) shape an individual's fertility decisions. Moreover, another innovative approach was adopted by Aparicio Diaz & colleagues (2011), who applied an agent-based simulation model to assess the importance of social interdependencies among individuals for explaining fertility changes in Austria during the period 1984-2004.

We contribute to this growing line of research by studying the effect of the friendship network on an individual's childbearing. Although it is to be expected that friends will have an influence on each other in their family formation behaviours, cross-friend effects on fertility have not yet been scientifically examined. Therefore, the aim of this paper is to examine if and how friends' fertility behaviours affect the individual's transition to parenthood. In doing so, we adopt an analytical strategy that allows us to properly identify interaction effects while ruling out possible confounding factors.

Overall, our paper provides two distinct, yet interrelated, contributions to the literature. The first contribution is the proposal of an innovative strategy to deal with

identification issues that are typical of social interaction processes. By exploiting the network panel survey design of the Add Health data, we use a dynamic model in which we disentangle selection and contextual effects from true friends' influence effects. On top of this methodological innovation, our second contribution relates to the theoretical mechanisms underlying the effects of social influence on fertility behavior among friends. We offer a theoretical framework that integrates knowledge from both sociology and economics to specify pathways via which cross-friend effects influence fertility behavior.

In the remainder of this paper, we first outline our theoretical assumptions and state our hypotheses. We then describe the data and the study sample, while explaining our empirical strategy. Finally, after presenting our results, we conclude with a discussion and reflection on the theoretical and practical implications of our findings.

5.2 Theoretical framework

Building on diffusion and social interaction theories (Bongaarts & Watkins 1996; Montgomery & Casterline 1996; Kohler 2001; Bernardi, 2003), the starting assumption of this paper is that an individual's life course decision-making, such as the decision to become a parent, is not only driven by their own personal characteristics and relevant contextual factors, but is also influenced by the characteristics and behavior of the people with whom they interact.

According to socialization theories, an individual's behavior is shaped by interactions with relevant socialization sources (Oetting & Donnermeyer, 1998). In existing fertility research, most of the studies have identified the main socialization source as the family. They have emphasized the importance on childbearing choices of socialization processes that operate through the direct transmission of fertility behaviors and attitudes from parents to children at a very early stage in life (Thornton, 1980; Barber, 2000; Murphy & Wang, 2001; Riken & Liefbroer, 2009) or through later intra-family interactions, such as those among siblings (Lyngstad & Prskawetz, 2010). However, socialization does not only occur within the kinship network but also outside it, through social exchange and interaction with peers and friends. In today's individualized societies, friends might be considered as equally or more important than siblings and other family members because they have been freely chosen by the individual. According to the Second Demographic Transition perspective (Lesthaeghe & Van de Kaa, 1986), voluntary relationships have gained in importance compared to ascribed family relationships. Therefore, we expect that interactions with friends might play a crucial role in an individual's fertility decision-making.

This paper specifically focuses on the transition to parenthood in early adulthood (people who are up to 30 years old). Keeping in mind that the transition to first birth in the United States happens at a relatively young age (according to the National Center for Health Statistics (NCHS) in 2008 the mean age at first birth was 25 years), young adults

are a very suitable sample for investigating whether and how transition to parenthood is affected by cross-friend interactions. A growing body of research has emphasized the important influence that peer social networks have on an individual's behavior during early adulthood (Veenstra & Dijkstra, 2011). These studies have focused on peer effects on health (e.g., obesity, Christakis & Fowler, 2007; Fowler & Christakis, 2008; or smoking behavior, Mercken et al, 2009, Pollard et al., 2010), and other individual outcomes (e.g. delinquency, Knecht et al., 2010, or sexual behavior, Ali & Dwyer, 2010), and show how these behaviors spread within the network, becoming contagious. Building on this literature, we believe that cross-friend effects on fertility might be particularly strong among young adults, and are likely to affect the probability and timing of becoming a parent.

In fertility research to date, two main mechanisms have been identified as channels via which social interaction works: social influence and social learning. The first process identifies how consensus within a peer group can constrain attitudes and behaviour, whereas the second refers to how individuals gain knowledge from others (Montgomery & Casterline, 1996; Kohler et al., 2001). Certainly, friends play a crucial role in both mechanisms. Social influence among friends might be very well explained by the theory of social comparison (Festinger, 1954) and the concept of descriptive norms (Cialdini et al., 1990). According to the theory of social comparison, individuals adapt their behaviour to match someone that is considered to be in a similar social position or with whom they share similar characteristics. Friends clearly belong to this comparative group and an individual will therefore be likely to conform to the behaviour of their friends. Similarly, Cialdini et al. (1990: 1015) present the importance of the effect of *descriptive norms* on an individual's conduct. These norms are defined as "what is typical or *normal*, thus, what most people do", and, subsequently, this becomes most "sensible to do". In line with this argument, Rindfuss & colleagues (1988) have shown that norms play a primary role in shaping the transition to first birth and its timing in the United Sates. Therefore, it is likely that individuals who have several friends with children might be more likely to have one as well. Friends are also a source of learning. Alongside an individual's siblings (Axinn et al, 1994; East, 1998), friends offer behavioural examples. Their childbearing experiences can provide relevant information on how to face the transition to parenthood and deal with the substantial life changes it brings about (Bernardi, 2003).

In addition to social influence and social learning, economic theories also highlight how diffusion processes in fertility can be explained by cost-sharing mechanisms and network externalities (Kuziemko, 2006). Having a child is associated with uncertainty, monetary and non-monetary costs (e.g., foregone earnings, opportunity costs in terms of a professional career or maintaining a certain social life). Uncertainty and non-monetary costs might be particularly high in the transition to first birth, because it is a transition to a completely new life state, that is, parenthood (Billari et al., 2009). As shown by Lyngstad & Prskawetz (2010), the recent childbearing of a sibling has a strong positive effect on first-

birth rate, whereas this effect is almost negligible on the second child. Building on this, we extend such reasoning to a friendship context. We assume that having friends with whom an individual can share their experience as a parent might reduce the uncertainty associated with it. Friends can not only share practical information, but also their feelings and worries. Moreover, experiencing this unique life transition as the only person within a peer group likely leads to higher relational costs. Becoming a parent is a radical change in one's lifestyle that strongly impacts the amount and nature of leisure time, including time spent with friends. The opportunity of experiencing parenthood together with other friends makes this transition less costly from a relational perspective. With life changes in a social group synchronized (or at least shared), the risk of being left alone or lagging behind is reduced. Looking at this mechanism from the benefit side (i.e., network externalities, Katz & Shapiro, 1985; Kuziemko, 2006), having a child around the same time as other friends likely makes the whole childbearing experience more enjoyable as it is "consumed" together.

Based on the above outlined social interaction mechanisms, we expect that a friend's childbearing can trigger an individual's decision to have their first baby. Therefore, the first hypothesis we propose is:

H1) a friend's childbearing has a positive effect on an individual's entry into parenthood (i.e., first-birth).

Kuziemko (2006) and Lyngstad & Prskawetz (2010) have consistently shown that cross-sibling effects on fertility have a specific time pattern. The contagion effect is very strong and increases in the first 12 (Lyngstad & Prskawetz, 2010) to 24 months (Kuziemko, 2006) after the sibling's childbearing. This influence then declines, becoming negligible after three years.

We expect to find a similar time pattern among friends which we attribute to an individual's cost-sharing strategy. As mentioned earlier, when friends experience the transition to parenthood together, it might reduce the relational costs that are inevitable with such a transition. Therefore, an individual should become a parent around the same time as their friends. By synchronizing their life path with that of a friend's, they coordinate these important life changes. This leads us to assume there is a strong short-term influence, which is likely to become negligible over the long run.

The non-linear effect of social interactions on first birth outlined above, may also be explained by the pattern of happiness surrounding the birth of a first child (Pouwels, 2011). Rather than being seen in competition, this additional explanation would actually reinforce the cost-sharing argument. Pouwels (2011) has shown that in the year before and after the first childbirth, parents experience a sharp increase in their level of happiness. However, happiness is then found to drop some months after the delivery of the child and new parents are less happy than before the birth, for a long time. This curvilinear

relationship between happiness levels and childbearing seems to translate into a similar pattern on other people's fertility, with a lag-time of 1-2 years. Building on Fowler's and Christakis's findings (2008), in which happiness spreads within a social network, we assume that people are influenced by seeing their relevant others (e.g., siblings or friends) being happier when they become parents, and this in turn might have a positive affect on their desire to have a child. Conversely, seeing the unhappiness of new parents might also make people (more) aware of the difficulties associated with childbearing, thereby reducing their own likelihood to have a child. The lag time of 1-2 years in an individual's reaction is consistent with the average time it takes to conceive and deliver a child (Gnoth et al., 2003).

Following the cost-sharing argument, and in light of the relationship between happiness and transition to first child, we hypothesize that:

H2) the effect of a friend's childbearing on an individual's risk of becoming a parent is:
a. A short-term effect
b. Inverse U-shaped: an individual's parenthood rate increases in the period following the childbearing of a friend, and, after reaching this peak, it starts to decrease.

While acknowledging a few studies on the use of contraceptives in developing countries (Behrman et al., 2002; Kohler et al., 2001), and the qualitative analysis of Bernardi (2003), up-to-date research lacks quantitative studies on the role of friendships and cross-friend effects on fertility. The primary reason rests with the nature and the process of friendship formation. Rather than being ascribed, friendships are voluntary relationships meaning that individuals freely select their friends. This selection can be direct, with individuals choosing their friends based on similarity in behaviour and attitudes (Lazarsfeld & Merton 1954). Alternatively, selection can be indirect, where people enter social settings in which they live (e.g., school, workplace, etc...) and within these settings they bond with similar people because they share the same social context (Feld, 1981, 1982). The first selection mechanism (defined for this paper as *selection*) is widely explained in terms of homophily, which assumes similarity in behaviour as a cause of interpersonal relationships (McPherson et al., 2001). The second selection mechanism is actually a correlation between similarity in behaviour and friendship formation. It arises from confounding contextual effects, as people who live in (and sometimes deliberately choose) the same social context will also share similar characteristics (defined for this paper as *contextual effect*).

These selection and contextual effects make it difficult for researchers to disentangle the role of social influence from other determinants (*influence* here being defined as a synonym of "pure" social interaction effect), such as individual or contextual factors, which may affect both friendship formation and fertility decisions. Variables that should measure social interaction effects might be correlated with unobserved factors that affect the individual probability of having a child as well as bonding with a specific friend (Kravdal, 2003). To avoid severe bias in the estimates, and therefore to properly identify

social interaction effects, suitable model specifications and exclusion criteria are needed (Manski 1993, 1995). The relevance of this identification problem is evident from the active and ongoing debate on possible empirical strategies to disentangle selection and contextual effects from influence (Christakis & Fowler, 2007; Cohen-Cole & Fletcher, 2008; Fowler & Christakis, 2009; Bramoullè et al., 2009; Steglich et al., 2010; Fletcher, 2011. Note that in this literature, selection, contextual and influence effect are defined in several different ways). Given that this issue remains very much open, in this paper we propose an innovative way of addressing some of the methodological difficulties. We aim to investigate cross-friend effects on fertility behavior, net of selection and contextual effects. In the next section, we provide a detailed description of our analytical strategy.

5.3 Data and method

Data and sample

The data comes from the four waves of the National Longitudinal Study of Adolescent Health (Add Health) in the United States, a panel study of a nationally representative sample of adolescents, who in Wave I (1995) were in grades 7-12. The Add Health cohort (born between 1976 and 1982) has been followed into young adulthood with four in-home interviews (Wave I in 1995, Wave II in 1996, Wave III in 2001-2 and Wave IV in 2008-9), at the end of which the sample was aged between 24 - 32 years. Add Health provided an opportunity to make use and combine three different types of information: longitudinal data on respondents' socio-economic, psychological and physical characteristics, information on their life course events and trajectories, and data on social context and networks (e.g., family, neighborhood, community, school, friendships and peer groups). Therefore, these data perfectly serve our purpose of investigating the impact of social interaction among friends on the transition to parenthood.

We restricted our sample to women who were at least 15 years of age at Wave 1, who were observed through to around age 30. The decision to exclude men from our analysis rests with substantial data limitations. As explained by Schoen et al. (2007) and Amato et al. (2008), there is a systematic misreporting of childbirths in the fertility history modules (refer to the mentioned studies for further details). However, while we could make use of the information in the household roster to adjust omitted fertility data for women (we followed the same procedure described by Schoen et al. in their paper, 2007: 810), this was not possible for men and they were excluded from our study sample.

In Wave I, in-home and in-school questionnaires were administered to 20,745 respondents. In the latter questionnaire, in-school network information was collected and up to 10 friendship ties for each respondent were identified. In Wave III, a follow-up of the Wave I network module (or *friends module*) was administered to 3,572 respondents, who were in the 7th or 8th grade at Wave I. From this group we included all women who

were interviewed in all three previous waves, as well as Wave IV (the last wave). Our final sample consisted of 1,726 individuals.

In the *friends module* of Wave III, respondents were asked a battery of questions about their current relationship (or lack thereof) with 10 former schoolmates. These 10 people were selected into a respondent's questionnaire by a name generator based on the probability of remaining friends with that respondent1. Therefore, selections were based on the in-school network information and behavior characteristics collected in Wave I. Every schoolmate selected was also a respondent in the previous Waves, as well as the in-home survey at Wave III. Among the 10 former schoolmates of each respondent, we excluded men (with the same reasoning for only including women in our sample), and those who were identified as kin (e.g., cousins, siblings), in order to specifically focus on former schoolmates who were not part of the family network. Using information on friendship status at Wave III, we defined two typologies of network relationship: *peers* (i.e., former schoolmates who have never been friends) and *friends* (i.e., former schoolmates who became friends during high school and remained so over time). From a respondent's list of 10 former schoolmates, we excluded any individuals who were previously friends with the respondent but did not remain so at Wave III (i.e., former friends). This exclusion was performed because there was no reliable information on the time length of the friendship and therefore we could not analyze the pattern of influence of former friends. The friendship network that we could draw for each respondent using the *friends module* of Wave III represents only a partial view of an individual's entire friendship network. Therefore, we assume that the partial network of friends from high school is a representative selection of an individual's entire friendship network during early adulthood. The implications of this assumption are discussed in the concluding section of this article.

From our sample, each respondent had an average of 3.5 peers and 0.8 friends. Our analysis includes 7,256 dyads, among which 1,357 (19%) are friendships. In total, 967,231 dyadic spells are included in our analysis. During the considered exposure time, 820 respondents became parents; the median age at first birth being 27.2 years.

Empirical strategy

In order to test whether a friend's childbearing has a positive effect on an individual's risk of becoming a parent, we engaged in a series of discrete time event history models with random effects at the dyadic level. Although the inclusion of dyadic random effects allows us to control for unobservable time-constant factors that affect both members of

1. Probable friends were chosen based on two types of information: the attributes' similarity between ego and alter (i.e., the former schoolmate) and the relative network position of ego and alter. The predicted probability of being friends is based on a dyad-level logistic regression. Further details provided by the Add Health team can be found in appendix A1.

the dyad (e.g., same experiences during adolescence, similar attitudes and preferences, and so forth), contextual and selection effects still need further consideration.

To properly disentangle any confounding contextual effects from true influence effects, we adopted a strategy that draws on the work of Bramoullè & colleagues (2009), who identified peer effects through characteristics of the network. We exploited the Add Health survey design, in particular information available on the network structure from the *friends module* at Wave III. Similar to a strategy used by Elwert & Christakis (2008), who disentangled causation from shared-exposure bias in the "widowhood effect" between spouses by examining both wives and ex-wives, we distinguished dyads of friends from those of peers. We considered two former schoolmates as friends when at least one of the two individuals had identified the other as their current friend at Wave III. Peers were defined as pairs of individuals who went to high school together but were never friends. By including and estimating both types of relationships in our analysis, we could separate the effect of the shared social context (operationalized by peer effect) from the cross-friend interaction effect.

Our unit of analysis is the unidirectional dyad (i.e., friendship might not be symmetric), from which we aim to model the fertility behavior of one of the two members as a function of the occurrence of the other's childbearing. Therefore, the outcome of the same individual is repeated for each peer and/or friend. Moreover, the same individual can act both as respondent *i* and as peer/friend *j.* This strategy was chosen on the assumption that each dyad in our sample is independent. Therefore, it might not take into account that friends of the same respondent might also influence each other. We could not include an individual fixed effect in the regression model because women who were censored (did not experience childbearing during the period of observation) would otherwise not have been included. However, in order to check whether the assumption of independence between dyads was too restrictive, we engaged in a permutation test, reported in Appendix A2. This robustness check gave consistent results with those we report in the following part of the paper.

We treated selection in two alternative ways, by making and consequently implementing two different assumptions. In the first stage, in virtue of the survey design, we assumed friendship to be exogenous to fertility decision-making. Friendships and peer relationships under study were formed when respondents were around 12-15 years old at the latest (Wave I); therefore, we could assume that their formation is exogenous to the decision to have a child. In other words, the decision to become friends is antecedent to, and therefore independent from, the decision to become a parent. It is very unlikely that adolescents choose their friends based on their family attitude and orientations. However, because we followed individuals and friendships over time, a selection issue might arise. From a certain age onwards, people may decide to remain friends only with people who share similar family attitudes. Therefore, in a second stage, we made a less restrictive

assumption that friendship might be endogenous to fertility decision-making. To control for the fact that the two decisions (i.e., having a child and choosing a certain friend) might be interrelated, we then engaged in a simultaneous equation model.

As the economic literature has highlighted (Manski, 1993), another issue that arises in the identification of social interaction effects is that of "reflection". This term refers to the difficulty in disentangling whether an individual's behavior is the cause or simply the reflection of their friend's behavior. In our strategy this issue does not seem to affect our analysis. By exploiting the panel design, we can assume that if the friend's childbearing occurs before the individual's childbearing, the former can only be the cause of the latter, and not the reflection of something that has not yet happened.

In the following sections, two different model specifications are proposed. The second one advances the first by specifically modeling the time pattern of cross-friend effects. Within each model design, selection is first treated as exogenous and then assumed endogenous to the fertility process.

Model specification 1: Modeling cross-friend effects using time-varying covariates.

In order to model the hazard of having the first birth during month *t* for individual *i* having a peer/friend *j*, we used a *probit* discrete time hazard function. The hazard function for the probability that the respondent *i* of the dyad *ij* becoming a mother at time *t* is represented by $h_{ij}(t)$, where:

$$(1)\quad \Phi^{-1}(h_{ij}(t)) = \alpha D_i(t) + \beta_1 X_i + \beta_2 Z_i(t) + F_{ij}\beta_3 P_j(t) + (1 - F_{ij})\beta_4 P_j(t) + u_{ij}$$

$D_i(t)$ is the baseline hazard, that in our case is a quadratic function at time *t* of the individual *i*'s duration (in age) between entry into the risk set (age 15) and the childbirth:

$\alpha D_i(t) = \alpha_0 + \alpha_1(age_i) + \alpha_2(age_i)^2$. X_i and $Z_i(t)$ are observed time-constant and time-varying covariates, respectively. They measure the observable characteristics of individual *i,* which affect *i*'s transition to first birth. $P_j(t)$ is a time-varying variable indicating when the other member of the dyad, *j*, had their first child. F_{ij} is a dummy variable and its value depends on the relationship between individual *i* and *j*. If *j* is a *friend* of individual *i*, F_{ij} takes on value 1. Vice versa if *j* is a *peer* of individual *i,* F_{ij} takes on value 0. Unobserved time-invariant dyad-specific factors are represented by normally distributed random effect u_{ij}, with zero mean and variance estimated by the model.

To carry out this analysis, we created a dyad-month file and we assumed that each dyad of female friends is independent. For each of the 7,256 dyads, we set the dependent variable as a dummy that takes on value 1 when the individual *i* gives birth and 0 for the other months. This variable was computed using the fertility history of each respondent up to Wave IV.

So far, we have assumed friendship formation to be exogenous to fertility decision-making. In order to relax this assumption, we needed to jointly estimated the individual *i*'s risk of becoming a parent and the probability for individual *i* to be a friend of individual *j*. We engaged in a recursive bivariate probit model. That is, we jointly estimated two probit models with correlated error terms and robust standard errors clustered by dyad, in which the binary dependent variable of the second equation is an endogenous regressor in the first equation (Wilde, 2000). This model belongs to the class of simultaneous equation models with dummy endogenous variables developed by Heckman (1978). However, the recursive bivariate probit model is characterized by having both dependent variables as binary and it can be estimated using full information maximum likelihood. This latter feature allows the model to be identified by functional form, also in the absence of any exclusion restriction. In our model, the first equation predicts the individual *i*'s risk of becoming a parent using the same variables as Equation 1. The second probit equation predicts the probability for individual *i* to be friends with individual *j* based on similarities between *i* and *j* and their geographical distance. Based on the homophily theory, people with similar characteristics and background (we specifically considered similarities in race, parental education and income and family type) are more likely to be friends. Moreover, former schoolmates who lived close to each other during high school (at Wave I) as well as afterwards (at Wave III) are also more likely to stay in touch and be friends. We assumed that the individual *i*'s risk of becoming a parent is only influenced by their own characteristics and the potential occurrence of the friend *j*'s childbearing, but not by dyadic common characteristics (i.e., similarities between friends), that we therefore considered as exogenous. These latter characteristics, together with the geographical distance, are instead assumed to affect friendship formation, thereby acting as exclusion restrictions. Therefore, our simultaneous equation model has the following form:

$$(2)\quad \begin{cases} \Phi^{-1}(h_{ij}(t)) = \alpha D_i(t) + \beta_1 X_i + \beta_2 Z_i(t) + F_{ij}\beta_3 P_j(t) + (1 - F_{ij})\beta_4 P_j(t) + \varepsilon_{1ij} \\ \Phi^{-1}(\Pr(F_{ij} = 1)) = \alpha_0 + \alpha_1 H_{ij} + \alpha_2 G_{ij} + \varepsilon_{2ij} \end{cases}$$

where $h_{ij}(t)$ is the individual *j*'s risk of becoming a parent and $\Pr(F_{ij} = 1)$ is the probability for individual *i* to be friends with individual *j*. The error terms of the two equations are correlated, that is, $cov\ [\varepsilon_1; \varepsilon_2] \neq 0$. In the first equation of the two systems, we used the same variable specification of Equation 1, so the reader should refer to the above-mentioned description of variables. For the second equation, H_{ij} are a set of dummy variables that take on value 1 when individual *i* and *j* share a given characteristic, and a value 0 when a characteristic is not shared. We specifically considered similarities in race, parental education and income and family type (e.g., single, step or both parent family during adolescence). G_{ij} represents the geographical distance between *i* and *j* and it is computed using two dummy variables that

take on value 1 when both members of the dyad live in the same census tract, respectively at Wave I and Wave III.

Model specification 2: Modeling cross-friends effects using a piecewise strategy

To study timing of the influence on childbearing among friends, we adopted a piecewise approach to model the time pattern of cross-friend effect on transition to first birth. Specifically, instead of estimating time-varying covariates for a friend or peer's childbearing (β_3 and $\beta_{4\,\mathrm{in}}$ Equation 1), we used dummy variables. There were four for each possible type of tie, i.e., friendship and peer relationship. These variables were given a value of 1 if the friend or peer had a child in the last 11 months, 12-23 months, 24-35 months, or more than 36 months. This model has the following form:

$$(3)\quad \Phi^{-1}(h_{ij}(t)) = \alpha D_i(t) + \beta_1 X_i + \beta_2 Z_i(t) + F_{ij}\sum_{k=1}^{4}\gamma_k P_{kj} + (1-F_{ij})\sum_{k=1}^{4}\delta_k P_{kj} + u_{ij}$$

In this model, P_{kj} represents a set of four timing dummy variables indicating when the friend or peer j gave birth.

Following the same strategy as before, we again relaxed the assumption of exogeneity of friendship within this model specification. The simultaneous equation model we used was (see the description of Model 3 above for details of the formula):

$$(4)\quad \begin{cases} \Phi^{-1}(h_{ij}(t)) = \Phi^{-1}(h_{ij}(t)) = \alpha D_i(t) + \beta_1 X_i + \beta_2 Z_i(t) + F_{ij}\sum_{k=1}^{4}\gamma_k P_{kj} + (1-F_{ij})\sum_{k=1}^{4}\delta_k P_{kj} + \varepsilon_{1ij} \\ \Phi^{-1}(\Pr(F_{ij}=1)) = \alpha_0 + \alpha_1 H_{ij} + \alpha_2 G_{ij} + \varepsilon_{2ij} \end{cases}$$

Control variables

In addition to controlling for unobserved time-invariant dyad-specific factors (by means of estimating random effects), we also included in our analyses several observable time-invariant and time-varying variables. We identified factors that might confound the effect of a friend's childbearing on the risk of having the first birth. Specifically, we controlled for relevant socio-demographic individual characteristics, namely, race, parental education and income, and family type (measured at Wave I). Moreover, besides including age as a measure of the baseline time profile, that we assume to be quadratic, we also included partnership status as a time-varying covariate (respondents indicated as co-habiting or married). The latter variable might strongly affect the risk of becoming a parent and therefore buffer potential cross-friend effects.

5.4 Results

Table 1 reports descriptive statistics of the sample, which are divided into two sub-samples: women who experienced childbearing in the observation period and women that had not become mothers by Wave IV. The two groups differ in their compositional characteristics. Early mothers are more likely to come from a low socioeconomic status, measured in term of parental education and family income at Wave I. Moreover, they are less likely to grow up in a family with both biological parents and they have, on average, more siblings. At Wave III, there were no substantial differences between the two groups in the number of friends or peers, with an average of 0.8 and 3.5, respectively. Therefore, there is no evidence of substantial differences in the number of network relationships between the two groups. Overall, a majority of women have experienced childbearing before Wave IV (52%), and the median age at first birth for our sample is 27 years.

Table 1. Descriptive statistics of the sample.

	No childbearing	Childbearing	Total
Parental education			
Less than high school	7.4	12.7	9.9
High school or equivalent	27.5	39.0	33.0
Some college	18.4	19.0	18.7
College education or more	39.0	17.8	28.9
Unknown	7.7	11.5	9.5
Family type			
Living with biological parents at Wave I	64.2	44.3	54.8
Living in a step family at Wave I	7.7	12.7	10.1
Living with single mother at Wave I	23.3	34.9	28.8
Living with single father at Wave I	1.4	2.7	2.0
Living in other type of family at Wave I	3.3	5.5	4.4
Race/Ethnicity			
Hispanic	8.6	10.6	9.6
Black	22.3	30.7	26.3
Asian	5.4	2.2	3.9
White	63.7	56.5	60.3
Parental Income			
1st quintile	17.3	28.9	22.7
2nd quintile	16.2	25.6	20.6
3rd quintile	22.0	21.1	21.6
4th quintile	20.9	15.4	18.4
5th quintile	23.6	8.9	16.8
Average number of siblings	1.49	1.71	1.6
Average number of friends	0.82	0.78	0.8
Average number of peers	3.43	3.55	3.5
Median age at first birth	-	-	27.2
Number of women observed	906	820	1726

Table 2 gives a description of the network dyads included in the models. Descriptive results indicate a high degree of similarity among friends in terms of race, parental education family type and parental income[2]. It shows that people bond with individuals from a similar background. However, the common social context is also responsible for a certain degree of homogeneity. Although peers seem to be less alike than friends, the difference in the degree of similarity between the dyads of peers and the dyads of friends is not much. This suggests that individuals who share the same context are similar with respect to a large set of demographic and socio-economic characteristics. Table 2 also presents a summary of geographical characteristics at the dyadic level. Friends exhibit a greater geographical homophily compared to peers at both Wave I and Wave III. The average distance between homes for two friends is lower than the average distance between peers, showing that pupils tend to be friends with schoolmates who live close by. The

Table 2. Overview of characteristics of the network dyads in the sample

	Peers	Friends	Total sample
Proportion of dyads with same race	0.72	0.82	0.74
Proportion of dyads with same parent education	0.31	0.36	0.32
Proportion of dyads with same family type	0.42	0.50	0.44
Proportion of dyads with same parental income	0.22	0.29	0.23
Proportion living in the same state at WI	1.00	1.00	1.00
Proportion living in the same county at WI	0.90	0.90	0.90
Proportion living in the same census tract at WI	0.28	0.39	0.30
Proportion living in the same block at WI	0.09	0.17	0.11
Proportion living in the same state at WIII	0.78	0.79	0.78
Proportion living in the same county at WIII	0.51	0.52	0.51
Proportion living in the same census tract at WIII	0.09	0.16	0.10
Proportion living in the same block at WIII	0.03	0.08	0.04
Number of dyads	5,899	1,357	7,256

geographical proximity between friends is also higher during early adulthood. Although we do not observe differences between dyads of friends and peers in the probability of living in the same state or county, we find that friends are much more likely to live in the same census tract or block. Therefore, we believe that geographical proximity can be used to model the probability to be friends at Wave III.

Results for the *probit* time hazard of becoming a parent are shown in Table 3, which reports the model estimating the friend's childbearing effect as a time-varying covariate, and Table 4, where the timing of the friend's childbearing is estimated using a piecewise approach.

2. Dummy variable measuring similarities are based on the same categories shown in Table 1.

In Table 3, Model 1 estimates the effect of a friend's childbearing on an individual's risk of having the first child, net of baseline hazard and control variables, but without controlling for contextual and selection effects. In line with hypothesis 1, we find that when a friend becomes a parent, an individual's risk of also becoming a parent increases. The duration pattern, as a quadratic function of an individual's age, shows a clear curvilinear shape. The positive effect of older age on first birth rate is coupled with a small negative effect of age squared, indicating that the effect of an individuals' age becomes weaker or negative, the older an individual is. As for the control variables, although they are not large, we observe some significant ethnic differences. Black and Hispanic women are at risk of becoming mothers sooner than white women. In line with previous studies (e.g., Rijken & Liefbroer, 2009), we find that people with a higher number of siblings, have a younger age at first birth. Moreover, when individuals co-habit or are married they are more at risk of becoming parents than individuals who are single. Looking at the economic situation of the family of origin, we observe that women who come from a family with poor economic status have a higher risk of becoming parents sooner than those with a high economic family background. A similar result is seen for the effect of parental education: people who have better educated parents seem to have the first child later than those who come from a lower educated family. Presumably, this effect is the result of the first group of individuals being more likely to stay in education, thereby delaying the entry into parenthood (Rijken & Liefbroer, 2009). Finally, we find that individuals who grew up with both biological parents become parents later than those who live their adolescence in a step- or single-parent family. Aside from the ethnic differences that seem to disappear once we control for selection, the effects of control variables are consistent across all models.

To control for contextual effects, Model 2 (reported in Table 3) takes into account the effect of a peer's childbearing. We find a positive effect of a peer's fertility on first-birth rate, although smaller than in the case of a friend. This means that social context plays a relevant role in shaping an individual's reproductive behavior. However, even after controlling for such a contextual effect, the influence of a friend's fertility is still significant, and actually stronger.

Model 3 and 4 (Table 3) report two simultaneous equation systems that allow us to estimates cross-friend effects on fertility net of selection effects. Given a dyad, we jointly estimate the risk of one dyad's member becoming a parent and the probability of being friends with another. In this way, we allowed the residual component of the two equations to be correlated. We wanted to make sure that similarities in fertility behavior among friends are the result of their interaction and not vice versa. Once people get older, they might choose to remain friends with those former schoolmates with whom they share similar family attitudes and plans. In this case, similarities in family orientations would be the cause and not the consequence of friendship. Model 3 shows that when we control for selection, cross-friend effects on childbearing are even stronger than in the un-adjusted models and ethnic differences disappear. The same findings can be found in Model 4,

Table 3. Coefficient estimates of the probit discrete time hazard of becoming a parent, using a friend's childbearing as a time-varying covariate

	(1)	(2)	(3)	(4)
Friend becomes mother	0.117*	0.130**	0.134***	0.137***
	(0.046)	(0.046)	(0.040)	(0.040)
Peer becomes mother		0.052*		0.026
		(0.025)		(0.020)
Age in years	0.435***	0.431***	0.340***	0.338***
	(0.046)	(0.046)	(0.030)	(0.030)
Age squared	-0.009***	-0.009***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Race *(ref: white)*				
Black	0.057*	0.054*	0.035	0.033
	(0.026)	(0.026)	(0.018)	(0.018)
Hispanics	0.079*	0.079*	0.034	0.034
	(0.038)	(0.038)	(0.026)	(0.026)
Number of siblings	0.053***	0.053***	0.039***	0.039***
	(0.009)	(0.009)	(0.005)	(0.005)
Parents with college education	-0.129***	-0.129***	-0.081***	-0.081***
(ref: parents with lower education)	(0.026)	(0.026)	(0.017)	(0.017)
Living with biological parents at Wave I	-0.201***	-0.200***	-0.135***	-0.135***
(ref: living in a single parent or step family)	(0.026)	(0.026)	(0.016)	(0.016)
Parental income *(ref: 5th quintile)*				
1st quintile	0.425***	0.420***	0.269***	0.267***
	(0.054)	(0.054)	(0.029)	(0.029)
2nd quintile	0.475***	0.471***	0.317***	0.315***
	(0.054)	(0.053)	(0.028)	(0.028)
3rd quintile	0.350***	0.348***	0.236***	0.235***
	(0.047)	(0.046)	(0.027)	(0.027)
4th quintile	0.218***	0.218***	0.153***	0.153***
	(0.043)	(0.043)	(0.028)	(0.028)
Marriage	0.386***	0.387***	0.303***	0.304***
	(0.046)	(0.046)	(0.040)	(0.040)
Cohabitation	0.248***	0.249***	0.205***	0.205***
	(0.024)	(0.024)	(0.021)	(0.021)
Constant	-8.280***	-8.226***	-6.672***	-6.648***
	(0.586)	(0.582)	(0.312)	(0.312)
Same race/ethnicity			0.239***	0.239***
			(0.052)	(0.052)
Same parent education			0.108*	0.108*
			(0.045)	(0.045)
Same type of family at Wave I			0.132**	0.132**
			(0.043)	(0.043)
Same census tract at Wave I			0.176***	0.176***
			(0.049)	(0.049)
Same census tract at Wave III			0.159*	0.159*
			(0.070)	(0.070)
Constant			-1.192***	-1.192***
			(0.051)	(0.051)
N of dyadic spells	557485	557485	557485	557485
σ_u	0.469	0.469		
	(0.063)	(0.063)		
ρ			-0.036**	-0.032**
			(0.012)	(0.012)
Log likelihood	-14962.859	-14960.702	-291268.093	-291267.172

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed test)

which is the most complete model as it also controls for contextual effects. Net of selection bias, a peer's childbearing no longer seems to affect an individual's risk of becoming a mother.

The second equation of Model 3 and 4 estimates the probability of being friends for a pair of former schoolmates, and we see that it is very well predicted by homophily. People who have the same race, similar parental education and family type are also more likely to be friends. Moreover, the closer they live, the higher the likelihood of being friends.

To investigate the time pattern of cross-friend effects on an individual's risk of becoming a parent, we adopted a piecewise approach. Models reported in Table 4 estimate the effect of a friend or peer's childbearing within 11 months, 12-23 months, 24-35 months, or more than 36 months. Following the same strategy used in the previous model specification (Table 3), we first estimated a model including only control variables and the dummy variables that measured when a friend's childbearing occurred (Model 1). We then included the set of dummy variables for a peer's fertility, thereby controlling for possible contextual effects (Model 2). Finally, we reported the two simultaneous equation models to adjust for selection, with and without peer effects (Models 3 and 4, respectively). In the first un-adjusted model we do not seem to find any cross-friend effects on an individual's risk of having the first child, whereas once we control for confounding, we find a curvilinear pattern in the years after a friend becomes a parent.

Model 2, in addition to the variables measuring a friend's childbearing, also includes the effect of peers on the propensity of first-birth. Estimates show that the effect of a friend starts to be significant one year after their childbearing. This increases, until reaching its peak around three years later, where it then starts to decline. Put another way, a woman is more likely to become a mother between one and three years after a friend has their first child (see Figure 1).

The influence of a peer's childbearing is much smaller and it seems to be U-shaped (Figure 1). There is a small immediate effect, which might be an age effect rather than being a real influence. Peers of the same age, who also come from the same social context, are likely to experience life transitions at a similar time. Moreover, we also observe a peer effect over a longer-term, after three years, which may be an indication of peer social pressure. With an increase of age, more people will have experienced childbearing. Women who see many people of their own age having had children may feel pressured and therefore also become more likely to have a child.

When selection bias is taken into account, models 3 and 4 show that a friend's influence effect is even more immediate. As shown in Figure 2, the influence reaches a peak at around two years, then declines. When we control for selection, in the same way as the previous model (Table 3), peers and ethnic effects are no longer significant.

Table 4. Coefficient estimates of the probit discrete time hazard of becoming a parent, modeling the timing of a friend's childbearing using a piecewise approach

	(1)	(2)	(3)	(4)
Friend (0-11 months)	0.065 (0.084)	0.076 (0.084)	0.111 (0.078)	0.112 (0.078)
Friend (12-23 months)	0.165 (0.084)	0.178* (0.084)	0.195* (0.077)	0.197* (0.077)
Friend (24-35 months)	0.167 (0.090)	0.181* (0.091)	0.176* (0.085)	0.178* (0.085)
Friend (36+ months)	0.099 (0.062)	0.120 (0.063)	0.102 (0.053)	0.107* (0.053)
Peer (0-11 months)		0.087* (0.041)		0.071 (0.036)
Peer (12-23 months)		-0.024 (0.049)		-0.040 (0.044)
Peer (24-35 months)		0.004 (0.048)		-0.005 (0.043)
Peer (36+ months)		0.080* (0.032)		0.038 (0.026)
Age in years	0.434*** (0.047)	0.438*** (0.047)	0.338*** (0.030)	0.339*** (0.030)
Age squared	-0.009*** (0.001)	-0.009*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)
Race *(ref: white)*				
Black	0.057* (0.026)	0.054* (0.027)	0.035 (0.018)	0.033 (0.018)
Hispanics	0.079* (0.038)	0.080* (0.038)	0.034 (0.026)	0.034 (0.026)
Number of siblings	0.053*** (0.009)	0.053*** (0.009)	0.039*** (0.005)	0.039*** (0.005)
Parents with college education *(ref: parents with lower education)*	-0.128*** (0.026)	-0.129*** (0.026)	-0.081*** (0.017)	-0.081*** (0.017)
Living with biological parents at WI *(ref: living in a single parent or step family)*	-0.201*** (0.026)	-0.202*** (0.027)	-0.135*** (0.016)	-0.135*** (0.016)
Parental income *(5th quintile)*				
1st quintile	0.426*** (0.054)	0.423*** (0.054)	0.269*** (0.029)	0.267*** (0.029)
2nd quintile	0.475*** (0.054)	0.474*** (0.054)	0.317*** (0.028)	0.315*** (0.028)
3rd quintile	0.351*** (0.047)	0.351*** (0.047)	0.236*** (0.027)	0.235*** (0.027)
4th quintile	0.218*** (0.043)	0.219*** (0.043)	0.153*** (0.028)	0.153*** (0.028)
Marriage	0.386*** (0.046)	0.388*** (0.046)	0.304*** (0.040)	0.304*** (0.040)
Cohabitation	0.248*** (0.024)	0.250*** (0.024)	0.205*** (0.021)	0.206*** (0.021)
Constant	-8.273*** (0.590)	-8.309*** (0.596)	-6.657*** (0.312)	-6.658*** (0.313)

Table continues on next page...

... table 4 continued

Second equation: probability of being friends				
Same race/ethnicity			0.239*** (0.052)	0.239*** (0.052)
Same parent education			0.108* (0.045)	0.108* (0.045)
Same type of family at Wave I			0.132** (0.043)	0.132** (0.043)
Same census tract at Wave I			0.176*** (0.049)	0.176*** (0.049)
Same census tract at Wave III			0.159* (0.070)	0.159* (0.070)
Constant			-1.192*** (0.051)	-1.192*** (0.051)
N of dyadic spells	557485	557485	557485	557485
σ_u	0.470 (0.064)	0.475 (0.064)		
			-0.036** (0.012)	-0.032** (0.012)
Log likelihood	-29962.3	-29959.8	-582584.5	-582585.6

Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001 (two-tailed test)

Figure 1. Estimates from a discrete model of the friend/peer's childbearing effect on the individual's risk of becoming a mother in the four years after the friend/peer's childbearing.

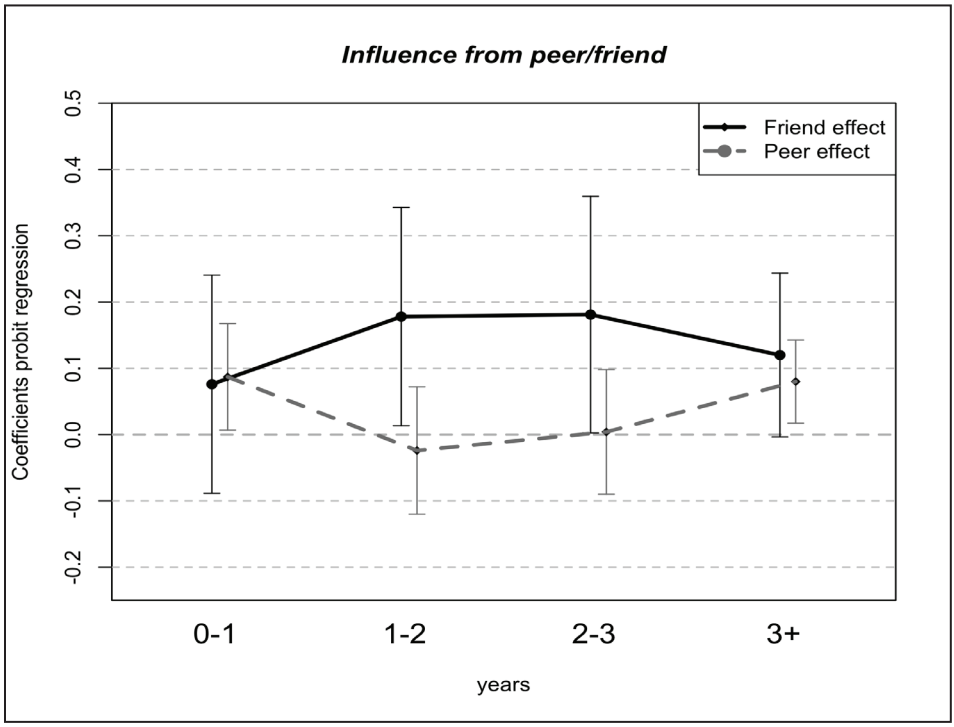
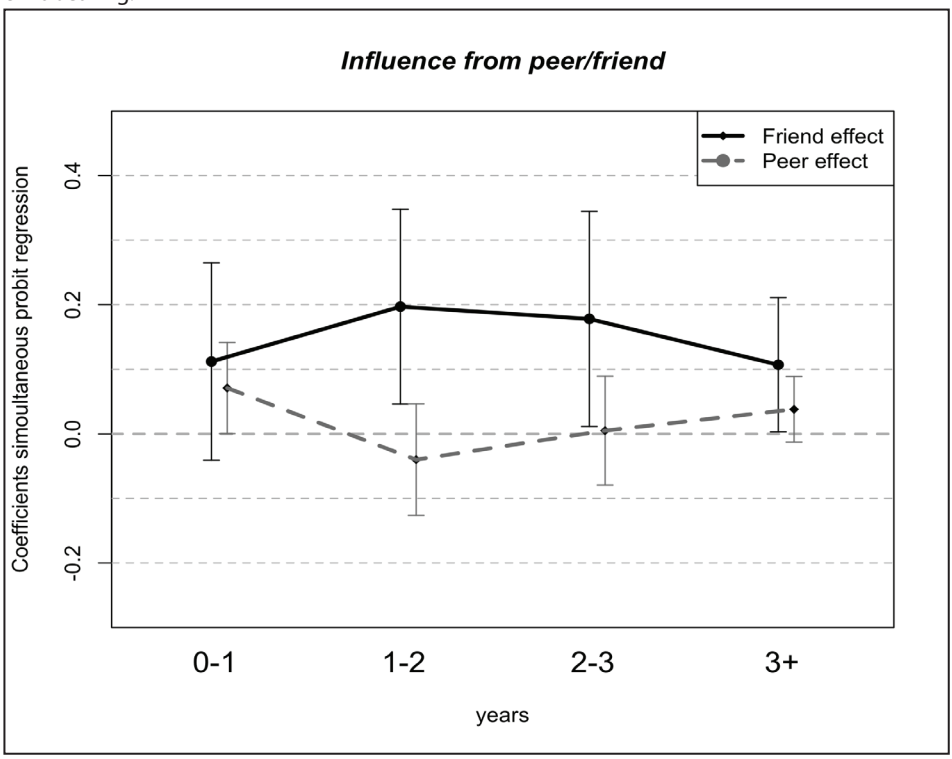


Figure 2. Estimates from a simultaneous equation model of the friend/peer's childbearing effect on the individual's risk of becoming a mother in the four years after the friend/peer's childbearing.



These findings support our second hypothesis, by giving evidence of a short-term, inverse U-shaped cross-friend effect on an individual's first-birth rate. This pattern clearly resembles the one found for cross-sibling effect on fertility (Kuziemko, 2006; Lyngstad & Prskawetz, 2010). It is interesting to note that, whereas sibling effects seem to be strongest less than one year after childbirth, cross-friend effects are somewhat more delayed (Lyngstad & Prskawetz, 2010). The more immediate influence of siblings might be due to cost-sharing dynamics being stronger within the family network.

In all of the models where we estimate a dyadic random effect (σ_u in Models 1 and 2 shown in Tables 3 and 4), we find a significant unobserved heterogeneity. This means that there are unobserved dyad-specific factors that influence an individual member of the dyad's risk of becoming a parent. Moreover, our simultaneous equation models (Models 3 and 4, shown in Tables 3 and 4), show a significant, although small, negative correlation (ρ). This can be explained as a signal, of the fact that the decision to remain friends with a certain former schoolmate might be marginally endogenous to the decision to have a child at a certain moment in life.

5.5 Conclusion

The aim of this paper was twofold. First, we attempted to contribute to existing research on the impact of social interactions on fertility by exploring the mechanisms underlying fertility diffusion effects among friends. Studies on the influence of friendship on fertility decision-making are lacking, and empirical efforts to identify processes via which social interaction works are still scarce. Our second contribution is at a methodological level. We proposed an innovative strategy that makes use of the panel survey design to properly identify social interaction effects and disentangle them from possible confounding effects.

We anticipated that a friend's childbearing experience might be an important source of learning, because it provides relevant and useful information on how to face the transition to parenthood. Moreover, a friend's behavior can also be a source of influence because people compare themselves with their friends. Next to social learning and influence, other mechanisms might also be involved. Drawing upon economic theories, we argued that fertility influence among friends may be the result of cost-sharing strategies. Transition to parenthood brings about high relational costs and extensive changes in one's life. Synchronizing childbearing with other friends might make the parenthood experience more enjoyable as it can be shared. This may also reduce the risk of being left behind by other friends who already have a child.

Using the 4 Waves of the Add Health data, we engaged in a series of discrete time event history models with random effects at the dyadic level. By exploiting the Add Health network design, we could distinguish dyads of actual friends from those of just former schoolmates (defined as peers) and, therefore, those people who simply shared the same social context. This allowed us to estimate cross-dyad childbearing effects for both types of pairs, separating true cross-friend interaction from contextual effects. Moreover, in order to distinguish selection from influence (people might remain friends with those who share similar family attitudes and plans), we engaged in a simultaneous equation model. In this, we jointly estimated the probability for an individual being a current friend with the other person in the dyad, and the risk for a member of the dyad becoming a parent.

Results showed that, net of selection and contextual effects, a friend's childbearing positively influences an individual's risk of becoming a parent. We found this effect to be short-term and inverse U-shaped: an individual's risk of childbearing starts increasing after a friend's childbearing, it reaches a peak around two years later, then decreases. While controlling for contextual effects, we found that the behavior of peers seems to have an effect only in the long-term. We interpreted this as an indication of social pressure. With the increase of age, women who see many people of their age having children may feel pressured to have one as well.

We acknowledge some limitations in the present study. First of all, the data we used did not allow us to look at the individual's complete network. We relied on the assumption

that the partial network of friends from high school is a representative selection of an individual's entire friendship network during early adulthood. Although we believe it is reasonable to assume that former schoolmates play a relevant role in a young adult's network, we do miss the complete picture. We acknowledge this assumption is less strong for those women who remain in education, where they connect to new friends at college or university and have possibly moved to another city. By looking only at high school schoolmates we make a conservative estimation of friend effects, which might underestimate the true social influence on fertility.

Our analytical strategy also led us to make another restrictive assumption, by considering each dyad in our sample as being independent. Although we consider this to be a limitation, we are, at the same time, confident that it was not detrimental to our analysis. As a robustness check, we relaxed this assumption and ran a permutation test, where consistent findings were obtained (see Appendix A2).

Finally, we could only measure friendship status of each dyad at Wave III, whereas we considered the fertility history of each respondent and friend/peer up to Wave IV (around 6 years later). We therefore assumed that those people who were friends at Wave III remained so afterward. Although this may not be true of all pairs, we consider it plausible that two former schoolmates, who have kept in touch for some years after they finished school, have been willing to invest in their friendship and it is therefore likely to be long-lasting.

We could undertake this study thanks to the availability of the network-based, panel data from Add Health. However, such datasets are scarce, especially in Europe. We hope that studies like the present one can show the importance of social interaction effects on fertility and in turn stimulate the collection of new network data on a large, international scale.

Similar to the study by Aparicio Diaz & colleagues (2011), which made use of an agent-based simulation model to study the macro outcome of social interaction effects on fertility among individuals, we believe that our analysis might also have relevant policy implications. Making use of real data, we showed that friendships strongly shape an individual's fertility choices. Acknowledging that friendship networks play a primary role in a young adult's life, policy-makers should take into account that social networks might work as leverage for family policies, particularly those addressed to young adults.

We believe that our study contributed important insights on the mechanisms via which friendship networks influence an individual's fertility behavior and also provided an interesting strategy to deal with identification issues. However, further research should be carried out to address whether social interaction has different effects on fertility for different social groups (e.g., by education or race). We hope that future studies can take into account social stratification while studying social interaction effects. Moreover,

a natural extension of this research would be to look at effects on men. Finally, as the family formation process consists of several, closely interrelated decisions (e.g., leaving the parental home, union formation, and childbearing), it would be very interesting to investigate whether cross-friend effects also work via other family formation decisions, such as marriage.

Appendix A1

Algorithm generating probable friends at Wave III

Probable friends were chosen based on two types of information: the attribute similarity of ego and alter, and the relative network position of ego and alter. The predicted probability is based on the dyad-level logistic regression model below:

$Y_{ij}=b_1$ (out - degree) $+b_2$ (in - degree) $+b_3$ (reciprocity) + b_4 (popularity difference) + b_5 (Pop Direction) + b_6 (Transitive return) + b_7 (Intransitive return) + b_8 (Transitivity *Same - grade) + b_9 (Intransitivity *Same - grade) + b_{10} (Same Grade) + b_{11} (Same Gender) + b_{12} (Number of Same Clubs) + b_{13} (Same Race) + b_{14} (Both been in fights) + b_{15} (Skip School) + b_{16} (Same School Crowd) $+e_{ij}$

Where $Y_{ij}=1$ if ego nominates alter, and 0 if not.

The first 3 measures capture simple network involvement properties: out-degree is the number of people ego nominates and in-degree is the number of people who nominate alter. Reciprocity = 1 if alter nominates ego, zero otherwise. The two popularity coefficients capture simple popularity difference (ego in degree minus alter in degree, both not counting any nominations from the other) and the direction of the difference (Popularity Direction = 1 if ego is less popular than alter). The transitivity and intransitivity coefficients capture balance processes within the school friendship network. A triad is balanced if, whenever ego sends to alter and alter sends to a third, ego also sends to the third. If ego does not send to the third, then the triad is intransitive. The transitivity measures (b_6, b_7, b_8 and b_9) capture how many transitive and intransitive triples would be created if ego nominated alter as a friend, differentiated by those within and between grade level. The next coefficients capture whether ego and alter are the same grade, same gender, how many clubs they both belong to, whether they are the same race (coded in 5 categories), two measures of delinquent activity (fighting and skipping school), and an indicator for whether they are members of the same school crowd, as identified by a cluster analysis of the friendship networks.

The model predicts friendships based on the in-school network and behaviour characteristics. However, all predicted friends are also in the in-home survey. As probable friends of ego were indeed chosen, the most likely people who were also selected for an in-home interview. Thus, there is a wide variance in the observed probability that alter is a friend, because each of ego's observed friends may not have been selected for an in-home interview.

Appendix A2

Robustness checks: permutation test

To test the assumption of independence of dyads, we engaged in a permutation test in where we compared the actual coefficient estimates with the effect that we would have obtained if friends had been assigned randomly. The correlation between dyads may reduce the standard errors of the estimates and affect the statistical tests leading to a type I error. In this way, we would have overestimated the influence of friendship on fertility because we would not take into account the actual network structure and the correlation between dyads. To check the robustness of our coefficient estimates we simulated 1,000 datasets in which we randomly assigned friends to the respondents. The permutation is stratified by the total number of friends, in order to shuffle respondents with the same friendship network size.

For each of the π simulated datasets we re-estimated the model and saved the new coefficient estimates $\hat{\beta}^{\pi}$. We then compared the estimates $\hat{\beta}$ of the original model with the distribution of the estimates obtained in the simulated models. This allowed us to assess the significance value p^{π} without any assumptions on the distribution of β. The significance value was calculated as:

$$p^{\pi} = \frac{\left(\# \quad of \quad \hat{\beta}^{\pi} \geq \left| \hat{\beta} \right| \right)}{\left(\# \quad of \quad \hat{\beta}^{\pi} \right)}$$

In this way, we could compare the actual coefficient with the null hypothesis H0: β=0. As in other statistical tests, *a priori* significance level of 0.05 is used for interpreting the significance of the results.

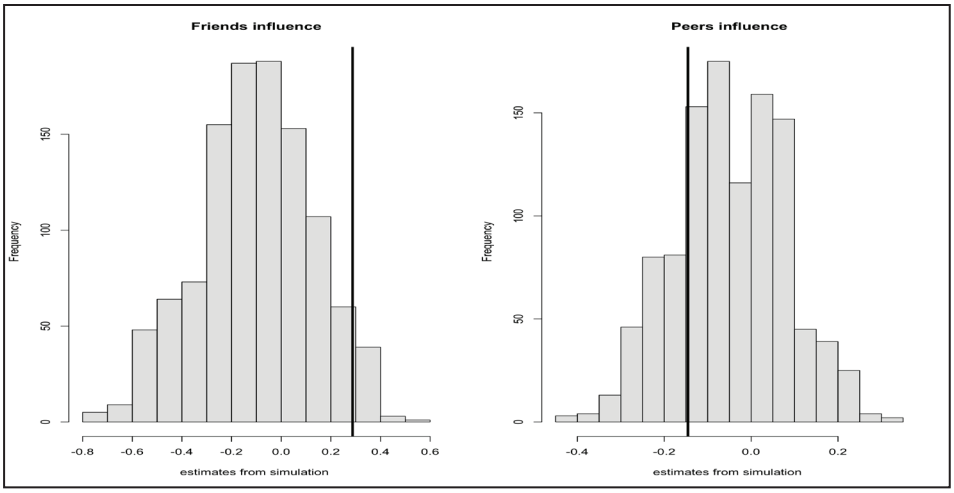
Our robustness checks provided results that are consistent with the analysis provided in the text. In the model without piecewise effects, the childbearing of a friend *j* significantly influences the probability for individual *i* of becoming a mother. Conversely, the effect of a peer does not significantly differ from zero.

The permutation tests in the model with piecewise covariates indicate that an individual's risk of having a child significantly increases one year after the childbearing of a friend. Peer effects are not statistically significant in the first 3 years and become non-negligible in the long term. The p-value of the permutation tests are reported in table A1. Figures A1 and A2 illustrate the distribution of the estimates under the null hypothesis of network independence.

Table A1. Permutation tests of Friends and Peer effects of discrete time hazard models

Coefficient	p-value
Models 1 and 2 *(see Table 3 in the text)*	
Friend becomes mother (β3)	0.041
Peer becomes mother (β4)	0.763
Models 1 and 2 *(see Table 4 in the text)*	
Friend effect (0-11 months)	0.181
Friend effect (12-23 months)	0.045
Friend effect (24-35 months)	0.028
Friend effect (36+ months)	0.026
Peer effect (0-11 months)	0.145
Peer effect (12-23 months)	0.425
Peer effect (24-35 months)	0.292
Peer effect (36+ months)	0.015

Figure A1. Distribution of simulated coefficients under random dyad assignments (null hypothesis). Actual estimates in solid line. Cross-friend model with time-varying covariate measuring a friend's childbearing



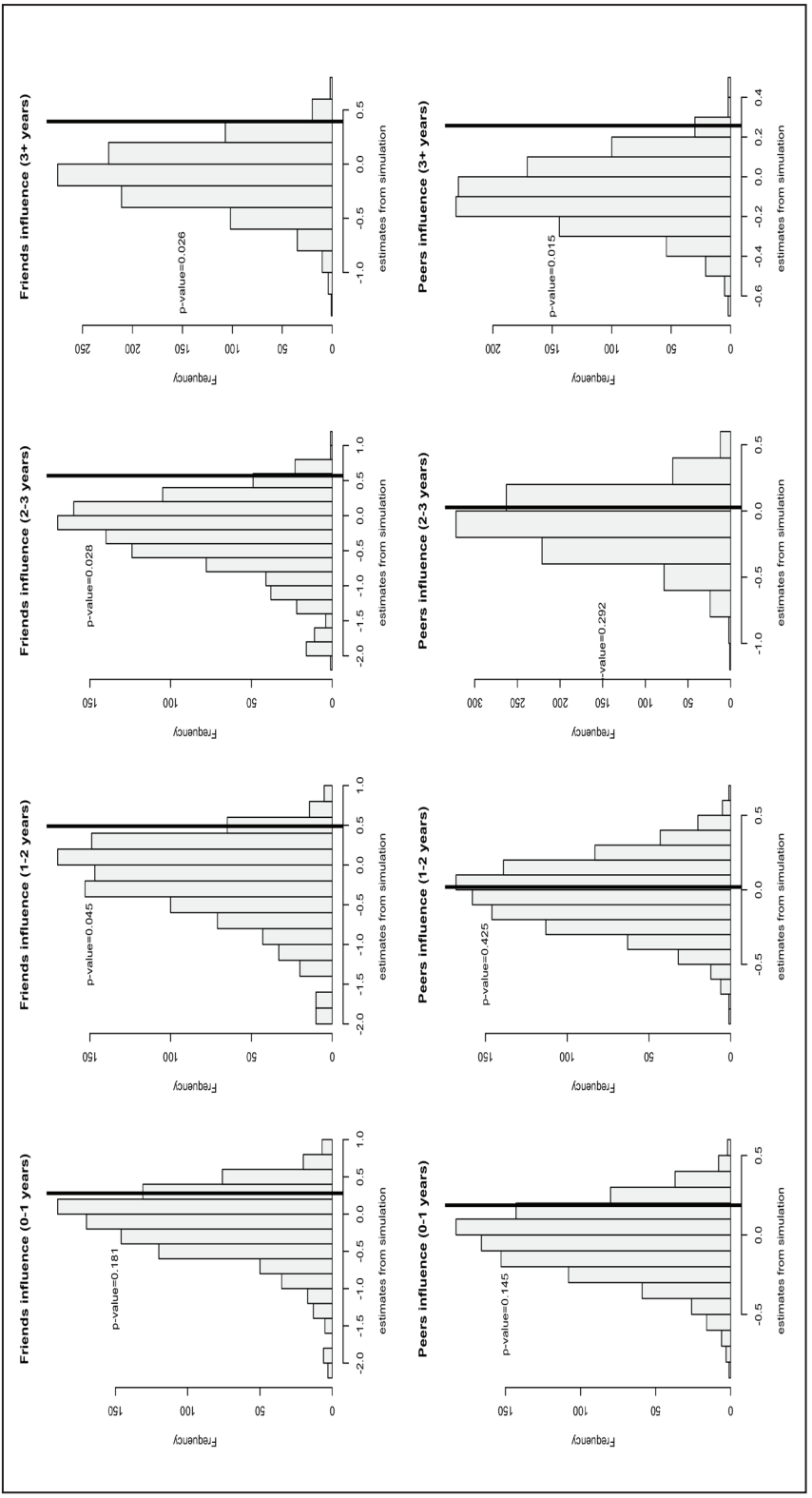


Figure A2. Distribution of simulated coefficients under random dyad assignments (null hypothesis). Actual estimates in solid line. Cross-friend model with piecewise effects for a friend's childbearing.

Friend and peer effects on entry into marriage and parenthood: A multiprocess approach to interrelated family-formation processes

6

This paper aims to investigate whether friends' and peers' behaviour influence an individual's entry into marriage and parenthood during the transition to adulthood of young, U.S. adults. After first studying entry into marriage and parenthood as two independent events, we then examine them as interrelated processes, thereby considering them as two joint outcomes of an individual's unique, underlying family-formation strategy. Using the National Longitudinal Study of Adolescent Health, we engage in a series of discrete time event history models to test whether the larger the number of friends and peers who get married (or have a child), the sooner the individual gets married (or has a child). Results show strong cross-friend effects on entry into parenthood, whereas entry into marriage is only affected by peer effects. Estimates of a multiprocess model show that cross-friend effects on entry into parenthood remain strongly significant even when we control for cross-process unobserved heterogeneity.

This chapter is based on:

Balbo, N., Barban, N., & Mills, M. Friend and peer effects on entry into marriage and parenthood: A multiprocess approach to interrelated family-formation processes. Paper presented at the "Fertility over the Life Course" conference, Bremen, September 12-13, 2012.

6.1 Introduction

There is an increased acknowledgement of the impact of interpersonal interactions and peer effects on modifying individual behaviour (Veenstra & Dijkstra, 2011). Recent studies have examined the impact of peer effects on obesity (Christakis & Fowler, 2007; Fowler & Christakis, 2008) smoking behaviour (Mercken et al, 2009, Pollard et al., 2010), alcohol consumption (Fletcher, 2011), sexual behaviour (Haurin & Mott, 1990; Ali & Dwyer, 2010), delinquency and criminal activities (Knecht et al., 2010; Patacchini & Zenou, 2011), educational achievements (Calvó-Armengol, 2009), (un)employment outcomes (Topa, 2001; Cappellari & Tatsiramos, 2010), happiness (Fowler & Christakis, 2008) and divorce (Mcdermott et al. 2009).

Research on the impact of peer and social interaction effects on demographic behaviour, however, has remained almost exclusively in the area of fertility. Diffusion and social interaction approaches (Bongaarts & Watkins, 1996; Montgomery & Casterline 1996) have demonstrated that fertility decision-making is affected by not only the individual's or couple's characteristics and the socio-institutional context, but also 'relevant others' behaviour (e.g., what relatives, friends, neighbours, colleagues think or do). These social interaction mechanisms have then been used to explain persistent differences in fertility trends across time and place (e.g., social multiplier effects; Kohler et al., 2002, 2006).

Research examining the impact of the social interaction effects of peers and friends (sometimes also referred to as cross-friend effects) beyond fertility behaviour has remained limited. Due to the lack of suitable data and difficulties with identifying endogenous interaction effects, quantitative research (e.g., Manski & Mayshar, 2003; Lyngstad & Prskawetz, 2010) has only marginally examined these questions. Research on family-formation behaviours beyond fertility is virtually absent, although the same theoretical considerations regarding the importance of social interaction could most certainly be applied to other demographic behaviours, such as marital decisions.

In the current study, we aim to extend existing research on social interaction effects by investigating to what extent friends' and peers' behaviour can influence the entry into marriage and parenthood during the transition to adulthood. In the demographic and sociological literature, entry into marriage and parenthood have been established as closely interrelated events, both in terms of their timing (Rindfuss et al., 1988; Manning, 1995; Mills & Blossfeld, 2005) and the life planning they imply (Liefbroer, 1999; Barber et al., 2002). Some studies have specifically addressed the issue of spuriousness of the relationship between these two processes (Lillard, 1993; Upchurch et al., 2002; Baizán et al. 2003; 2004; Steele et al., 2005; 2006). In an attempt to uncover the causal nature of the relationship between marital and fertility decision-making, this body of research has highlighted how inter-individual differences in subjective dimensions might affect both demographic processes.

Building upon and extending previous research, we introduce two main contributions to the field. First, we investigate how social interaction might impact the entry into marriage and parenthood differently. So far, diffusion and social interaction studies have almost exclusively focused on fertility. We extend the existing literature by examining friends' and peers' effects on two different family-formation behaviours (i.e., marriage and childbearing). Our second contribution is a theoretical and empirical extension of the social interaction and diffusion literature on marriage and family formation. We not only consider entry into marriage and parenthood as two independent transitions, but also as two joint outcomes of an individual's unique, underlying family-formation strategy. Our aim is then to uncover whether cross-friend interactions affect the interrelated decisions of getting married and having a child. In this way, we provide a unique contribution to the existing research, which until now has only investigated the effect of social interaction on isolated life-course outcomes (mostly fertility choices, such as cross-sibling effects on fertility, Lyngstad & Prskawetz, 2010).

The central research questions examined in this paper are: *Do cross-friend interactions affect both the entry into marriage and parenthood or do they only influence one of the two processes? Is there a difference in the susceptibility to the influence of friends versus peers between marriage and fertility processes? To what extent are the previously established peer effects on fertility affected by the presence of common unobserved heterogeneity?*

Our study focuses on the study of young adults in the American context, following them from age 15 until around 30 years. The transition to adulthood in the U.S. is particularly interesting to investigate because there have been substantial changes in family formation behaviours in recent years (Ryan et al., 2009). Whereas in 1970 the median age at first marriage for women was 20.8 and first birth was 21.4, in 2008 they reached 25.9 and 25 (U.S. Census Bureau, 2012). It is therefore relevant to uncover whether peer effects shape an individual's marital and childbearing decisions to determine whether social interactions might also play a relevant role in these macro-level, postponement trends. Young adults are an ideal group for studying cross-friend effects as research shows that peer social networks have a particularly strong influence on an individual's behaviours during early adulthood (e.g., Christakis & Fowler, 2007; Pollard et al., 2010; Knecht et al., 2010; Ali & Dwyer, 2010). We draw on the National Longitudinal Study of Adolescent Health (Add Health) and focus on women only due to data limitations, the reasons of which are described shortly.

6.2 Background

There is a growing acknowledgment of the importance of the social network for an individual's behaviour. Previous empirical applications within demography have examined the impact of social influence and learning on contraceptive and reproductive choices in developing countries (Kohler, Berhman & Watkins, 2001; Behrman, Kohler & Watkins,

2002). Although additional empirical research has recently emerged, it remains limited due to the lack of suitable network data and the complexity of the analysis required to identify social interaction effects and disentangle them from confounding effects. Until now, next to the qualitative work of Bernardi and colleagues (e.g., Bernardi 2003; Bernardi et al., 2007; Keim et al., 2009), which has provided relevant insights into how social influence and learning operate to impact fertility choices in advanced societies, several recent studies adopt a quantitative approach to examine fertility outcomes. They empirically demonstrate that social interactions among siblings (Kuziemko, 2006; Lyngstad & Prskawetz, 2010), co-workers (Hensvik & Nilsson, 2010; Ciliberto et al., 2010), friends (Balbo & Barban, 2012) and peers belonging to the same ethnic-religious group (Manski & Mayshar, 2003) shape an individual's fertility decisions.

Although it is plausible that social interactions affect demographic behaviour beyond fertility, research is limited. To our knowledge, only a handful of studies examine peer effects on union formation. Hernes (1972) developed a macro-level diffusion model of age at marriage, showing that the greater the share of married peers within a cohort, the higher the propensity to marry for individuals in such a cohort. Whereas Hernes assumes that members of the same cohort constitute the influential peer group, Drewianka (1999, 2003) instead identifies people living in the same geographical area (i.e., county) as the relevant peer group. Here the assumption is that an increase in the fraction of single persons aged 16-44 in a certain geographical area leads to a decrease in the propensity to marry for an individual living in that area. In a similar way, Nazio and Blossfeld (2003) used diffusion models to examine the spread the cohabitation in Germany and Italy. They found that the adoption of cohabitation across different generations of birth cohorts does not imply strong links across generations. In other words, cohabitation was not driven by intergenerational experiences or the increase in cumulative proportions across cohorts, but rather via the social modelling of peers.

An alternative approach is the use of agent-based models and simulated data to examine how social interdependencies shape respectively marital and fertility decisions (Billari et al. 2007; Aparicio Diaz et al., 2011). Although these simulations have the undeniable shortcoming that they *a priori* assume peer effect influences at the micro level, they offer the ability to assess to what extent macro dynamics in demographic behaviour can be explained by social interaction at the individual level. Aparicio Diaz et al. (2012), for instance, found that accounting for social interactions in an agent-based model, can explain the shift in the fertility rate observed in Austria between 1984 and 2004.

6.3 Theoretical Framework

To understand how cross-friend interactions and peers might influence family formation, we can draw on two bodies of literature. Both the sociological and demographic literature has identified the two processes of social learning and social influence, with the economic

literature offering the additional mechanisms of cost-sharing dynamics and network externalities.

Social learning and social influence

An individual's life course decision-making is not only driven by his or her own personal characteristics and institutional factors, but also by the characteristics and the behaviour of people with whom that individual interacts with (Bongaarts & Watkins 1996; Montgomery & Casterline 1996; Kohler 2001; Bernardi, 2003). A body of research in demography has identified two processes through which relevant others (e.g., relatives, friends, colleagues) matter for fertility choices: social influence and social learning (e.g., Montgomery & Casterline 1996; Kohler et al., 2001). Social influence refers to consensus in peer groups that constrains attitudes and behaviours, whereas social learning relates to how individuals gain knowledge from others.

Cost-sharing dynamics and network externalities

Economic research identifies two other possible, complementary channels via which social interaction might work: cost-sharing dynamics and network externalities (Kuziemko, 2006; Balbo & Barban, 2012). Cost-sharing dynamics refer to the opportunity for people consuming the same kind of goods or experiences to share the costs and uncertainty associated with it. Network externalities are instead defined as an increase in the benefit or surplus that an individual derives from an experience when the number of other people consuming it increases (Katz & Shapiro 1985). These two mechanisms emphasize two different aspects of the same sharing process: the former focuses on the cost side whereas the latter stresses the benefits. A certain experience does not only generate a particular value in itself, but it can also produce additional value when 'consumers' of such an experience interact with one another. This is called the synchronisation value and it is the essence of a sharing process (Liebowitz & Margolis, 1995).

We expect that friends might influence an individual's risk of both getting married and becoming a parent, although we believe that the main mechanisms via which such an influence occurs are different for the two life transitions. These two events indeed bring about different levels of costs and lifestyle changes, with entry into parenthood having deeper implications than marriage.

Entry into marriage

In contemporary U.S. society, marriage has become less normative and widespread than in the past (Manning & Smock 1995; Uecker & Stokes, 2008; Cherlin, 2005). At the same time, cohabitation has been increasing (Kennedy & Bumpass, 2008; Smock et al, 2008; Ryan et al, 2009), becoming the modal path to marriage (Huang et al., 2011). Young people largely view cohabitation as a pre-marital stage, not as a substitute for marriage

(Manning, Longmore, & Giordano, 2007). In this study, we examine only marriage and not cohabitation for both substantive and practical reasons. The primary reason is that it is less theoretically plausible that friends and peers influence the entry into cohabitation as opposed to marriage. Although cohabitation is increasingly widespread (Kennedy & Bumpass, 2008), it still lacks the strong symbolic meaning attached to marriage. Cohabitation decisions have been shown to be driven by practical reasons (e.g., to reduce living costs), with individuals often 'sliding' into cohabitation in a more diffuse manner (Stanely et al. 2006). Cohabitation is also not included in this study for practical reasons. Because cohabitation and marriage are not mutually exclusive, it is not possible to identify the specific cross-friend influence on these different partnership formation patterns.

Assuming that a large part of young adults get married after already co-residing with their partner or having experienced cohabitation with a former partner, the transition to marriage should not bring about a high degree of uncertainty, costs or considerable life changes. Therefore we do not expect that cross-friend effects primarily work via cost-sharing strategies or learning processes. Rather, people may be positively influenced by their friends who get married mainly because of the network externalities that can be generated and social influence mechanisms that lead people to conform to their friends (Nazio & Blossfeld 2003). Network externalities might for example consist of the opportunity to share the joy of the wedding experience or to together 'consume' the first steps of the new married life. Social influence, instead, might work via social comparison, pressure and social norms.

According to the theory of social comparison (Festinger, 1954), individuals adapt their behaviour to those who are deemed as being in a similar social position or who share similar characteristics. Because people tend to homophily in that they bond with similar others (McPherson, Smith-Lovin & Cook, 2001), they are thereby likely to conform to the behaviour of their friends. In this way, friends define normative conduct, or, in Cialdini's and colleagues' (1990) words, certain descriptive norms, which is 'what is typical or normal, thus, what most people do', and consequently what becomes 'sensible to do'. Building on this argumentation, we expect that *the higher the number of friends who are married, the greater an individual's risk of entry into marriage (H1).*

Entry into parenthood

Cross-friend effects on fertility likely operate mainly via social learning mechanisms and cost-sharing dynamics (Balbo & Barban, 2012). Compared to getting married, having a child brings about more uncertainty and costs (monetary ones, such as foregone earnings, opportunity costs in terms of a professional career, as well as non-monetary ones, such as relational costs) (Mills et al., 2011). We assume that having friends with children, with whom an individual can share his or her experience as a parent, might reduce the uncertainty associated with it because friends can offer behavioural examples

and provide relevant information on how to face the transition to parenthood and deal with the substantial life changes it brings about (Bernardi, 2003). Moreover, if one were the only person within a peer group going through such a unique life transition, there would be likely higher relational costs. Becoming a parent is a radical change in one's life, that strongly impacts the amount and the nature of leisure time, and thereby the time spent with friends. Therefore, having the opportunity of experiencing parenthood together with (or right after) other friends make this transition less relationally costly, because life changes within a social group are synchronised (or at least shared) and the risk of being left alone or lagging behind is reduced. Based on this, we pose the following hypothesis: *the higher the number of friends who have a child, the greater an individual's risk of becoming a parent (H2).*

Simultaneous influences on entry into marriage and parenthood

As multiple studies have shown, young adults continue to see a stable union as the optimal and appropriate setting for having a child (Manning & Smock, 1995; Hobcraft & Kiernan, 1995; Kiernan, 1999; Smock & Greenland, 2010; Thomson et al., 2012). Entry into parenthood is much higher in a co-residential partnership, and especially marriage, compared to singlehood (Baizán et al., 2004). However, a body of research has highlighted that this association might be spurious and therefore the sequence of events (e.g., first partnership and then parenthood) might not reflect a causal relationship. If living together with a partner increases the risk of having a child, the willingness of becoming a parent might accelerate the decision to form a union (Brien et al., 1999; Baizán et al., 2003, 2004). Put differently, there might be some common unobserved subjective factors that simultaneously affect both family-formation decisions (Aassve et al., 2006).

For this reason we therefore consider entry into marriage and parenthood as two joint outcomes of an individual's unique, underlying family-formation strategy. This strategy is influenced not only by unobserved personal family predispositions and attitudes, but also by unmeasured social norms, influence and pressure which an individual is exposed to within her social network. We envision these unobserved forces to influence both marital and parental decisions in a concordant way (e.g., either positively or negatively impacting both processes), leading people to choose consistent family formation paths over their life-course. In line with this argumentation, we therefore expect that *the risk of entry into marriage and having a first child might be partially determined by common individual factors, which are positively correlated (H3).*

Our ultimate goal is to uncover whether cross-friend effects on fertility, which have been found in previous research, are actually at play even when we take into account possible preceding cross-friend influence on the transition to marriage and control for common inter-individual heterogeneity affecting both marital and fertility decisions. For this reason, we focus on a conventional demographic pathway in which an individual first experiences marriage, followed by parenthood.

It is very difficult to theoretically argue and *a priori* anticipate how cross-friend effects on fertility might be affected by these factors, the presence of which needs to be determined in the first place. It may be that most of the cross-friend influences occur via marriage, with individuals positively affected by friends who get married, thereby entering into matrimony themselves. Cross-friend effects on an individual's risk of having a child might therefore simply be the consequence or side-effect of the influence of a previous marriage by a friend. If this is the case, once marriage and childbearing are investigated as joint decisions, the friend effect on childbearing might be lower or negligible. Considering the simultaneous forces at play, in line with the approach adopted by Steele and colleagues (2005), we opted to engage in an exploratory analysis without postulating any specific hypothesis.

Our approach has two principal drawbacks. First, we consider marriage as the only family formation mechanism. Second, in the multiprocess models, we restrict our analysis only on the influence of marriage on fertility and not the other way around. We decided to focus only on marriage as cohabitation and marriage are not mutually exclusive. The majority of married couples in US experienced cohabitation before marriage. We are, in fact, not considering recurrent events and acknowledge that multiple cohabitation experiences are common before marriage or childbearing. Studying friends' influence on multiple events can be problematic because is not possible to establish if friends are influencing the respondents or the reverse. Also, cohabiting friends can influence both the respondent's decision to cohabit, as well as the decisions to marry or have children. This would lead to the study of three different processes simultaneously, with cohabitation and marriage as competing processes. Moreover, we focus on the influence of marriage on childbearing and not the influence of childbearing on the propensity to marry. Because we are dealing only with first births, the other causal direction would have not been identifiable in the model. A possible solution to this problem would be to study multiple births in other to identify the effect of childbearing on the timing of marriage. Unfortunately, our sample is composed of young women and the proportion of women who experience higher parity before Wave IV is small (22.5 %). To overcome these limitations, we engage in a robustness check, in which we repeat the same analysis in a selected group where cohabitation is less common and childbearing outside marriage is very rare. Using the respondents from religious family (attending religious services at least once a week), we investigate if we observe the same causal mechanisms in peers and friends influence on family formation and fertility decisions.

6.4 Data and method

Data and sample

The data we use come from all of the four waves of the National Longitudinal Study of Adolescent Health (Add Health), a panel study of a nationally representative sample of adolescents in the United States, who were in grades 7-12 in Wave I (1995). The Add Health cohort (born between 1976 and 1982) has been followed into young adulthood

with four in-home interviews (Wave I in 1995, Wave II in 1996, Wave III in 2001-2 and Wave IV in 2008-9), at the end of which the sample was between 24 and 32 years old. Add Health provides us with the unique opportunity to make use and combine three different types of information: longitudinal data on respondents' socio-economic, psychological and physical characteristics, information on their life course events and trajectories, and data on the social context and networks (e.g., family, neighbourhood, community, school, friendships, peer groups). Therefore, these data optimally serve our purpose of investigating the impact of social interaction among friends on the transition to marriage and parenthood.

We restrict our sample to women only, not younger than 15 years old, who are observed until around age 30. The decision to exclude men from our analysis rests with substantial data limitations. As already documented by Schoen et al. (2007) and Amato et al. (2008), there is a systematic misreporting of childbirths in the fertility history modules (refer to the mentioned studies for further details). This underreporting of male fertility has also been found in other large surveys (e.g., Joyner et al. 2012). However, while we could make use of the information in the household roster to adjust omitted fertility data for women (we followed the same procedure described by Schoen et al. in their paper, 2007: 810), this was not possible for men. Thereby, men were excluded from the study sample.

In Wave I, in-home and in-school questionnaires were administered to 20,745 respondents. In the latter questionnaire, in-school network information was collected and up to 10 friendship ties for each respondent were identified. In Wave III, a follow-up of the Wave I network module (from now on referred to as the *friends module*) was administered to 3,572 respondents, who were in 7th and 8th grade at Wave I. Because we only included women in our study, our final sample consists of 1,903 individuals. Also, as we make use of information collected in Wave IV, women who dropped out after Wave III (N=177) are part of our sample but are considered as right censored after Wave III. In the *friends module* of Wave III, respondents were asked a battery of questions about the current relationship (or lack thereof) with 10 former school mates. These 10 people were selected into a respondent's questionnaire by a name generator based on the probability of remaining friends with that respondent.1 Every selected school mate was also a respondent in the previous Waves, as well as in the in-home survey at Wave III. Among the 10 former school mates of each respondent, we excluded men (for the same reason described previously), and those who were identified as kin (e.g., cousins, siblings), in order to specifically focus on former school mates who were not part of the family network.

1. Probable friends were chosen based on two types of information: the attributes' similarity between ego and alter (i.e., the former school mate) and the relative network position of ego and alter. The predicted probability of being friends is based on a dyad-level logistic regression. For further details, refer to Chapter 5.

Using information on friendship status at Wave III, we defined two categories of the network relationships: *peers* (i.e., former school mates who have never been friends) and *friends* (i.e., former school mates who became friends during high school and have remained so over time). Former friends who used to be the respondent's friends but were not any more at Wave III were excluded from the respondent's list of 10 former school mates. This was done due to the lack of reliable information on the length of friendship, which would not allow us to analyze the pattern of influence of former friends. The friendship network we could draw for each respondent using the *friends module* of Wave III represents only a partial view of an individual's entire friendship network. However, we assume that the partial network of friends from high school is a representative selection of an individual's entire friendship network during early adulthood, which has been shown by previous longitudinal studies (e.g., Chang et al. 2010).

Because we focus on individuals who first experienced marriage and then parenthood, we want to avoid any reverse causation of childbirth on marriage. We therefore censored individuals one month after the conception of their first child, thereby taking into account only transitions to marriage that occur before entry into parenthood. We extended the period of observation to one month after the time of conception because if marriage takes place within the same month in which a child is conceived, it is likely not the direct result of the pregnancy. If an individual does not experience the transition to parenthood, she is censored at the time of the last interview.

In this study, we only focus on first marriage as well as first child for two main reasons. First, respondents are relatively young at Wave IV, and therefore subsequent marriages and childbirths are rare events in our data. Secondly, by looking at recurrent episodes for each individual we would encounter what is termed as 'reflection' issues in the econometric literature (Manski, 1993). This refers to the difficulty in disentangling whether a friend's behaviour is the cause or just the reflection of the individual's behaviour. As we are interested in the unobserved factors affecting union formation as well as first parenthood, it is more meaningful to look at the union episode in which the entry into parenthood is more likely to occur. The link between first marriage and first birth is strong, with the first marriage a preferred setting to have the first child, whereas this is not necessarily true for first cohabitation. By only looking at first marriage and first birth, however, this problem does not seem to affect our analysis. By exploiting the panel design we have, we can assume that if the marital or fertility event of friends occurs before the one of the individual in question, the former can only be the cause of the latter, and not the reflection of something that has not yet happened.

In our sample, each respondent has on average 3.5 peers and 0.8 friends. During the exposure time under examination, 713 respondents got married and 842 became parents. The median age at first marriage is 28, while the age at first birth is 26.7.

6.5 Analytical strategy

To answer our research questions and test our hypotheses, we developed an analytical strategy that was able to tackle two main issues: (i) identification of cross-friend effects, disentangling them from contextual and selection effects; and, (ii) study of entry into first marriage and parenthood not only as two independent events, but also as interrelated processes, simultaneously affected by common unobserved individual factors (i.e., controlling for common unobserved heterogeneity). In this section, we describe how we address these two issues, focusing on them one-by-one.

Strategy to identify interaction effects

To empirically test whether friends' behaviours have a positive influence on an individual's risk of getting married and becoming a parent, contextual and selection effects have to be taken into account. The fact that friends act in a similar way might not necessarily be attributed (only) to cross-friend influence. Rather, two other mechanisms might operate as confounders. On the one hand, similarities in friends' behaviour might be the result of the fact that friends live (and sometimes even choose to live) within the same social setting and are exposed to the same contextual forces and factors (Feld, 1981; 1982). On the other hand, as people tend to bond with individuals who are alike, similar behaviours might be the cause, and not the consequence of preceding similar characteristics among friends (i.e., homophily, Lazarsfeld & Merton 1954; McPherson, Smith-Lovin & Cook, 2001). Building upon the strategy developed in Chapter 5, to disentangle confounding contextual effects from true cross-friend influence, we exploited the Add Health survey design and in particular information on the network structure from the *friends module* at Wave III. Similarly to the strategy used by Elwert & Christakis (2008), who disentangle causation from shared-exposure bias in the 'widowhood effect' between spouses by examining both wives and ex-wives, we identified and distinguished between two different categories of an individual's former school mates: friends and peers. Friends were classified as those who were identified as current friends by the respondent at Wave III. We defined peers as those who were merely former school mates of the respondent but have never been friends. Including and estimating both types of ties in our analysis allowed us to distinguish between the effect of the shared social context (operationalized by peer effect) from the cross-friend interaction effect.

By virtue of the survey design, selection is less of an issue in our analysis. We simply assumed friendship to be exogenous to the family-formation decision-making (i.e., both marital as well as fertility decisions). Friendships and peer relationships under study were formed at the latest when respondents were around 12-15 years old (Wave I); therefore we could assume that their formation is exogenous to the decision to marry or become a parent. Put differently, the decision to become a friend with someone is antecedent, and therefore independent from marital and childbearing choices. It is highly unlikely that a 12 year-old adolescent chooses friends based on their family attitudes and orientations.

Marriage and parenthood as two independent transitions

In our analysis, we first look at marriage and childbearing as two separate and independent life transitions. Only in a further step do we apply a modelling strategy that simultaneously estimates entry into marriage and parenthood as dependent processes (see next subsection).

We created an individual-month file, and, in order to be able to have the risk of marriage and parenthood as dependent variables, we computed two dummy variables that take on the value 1 in the month at which the individual *i* gets married or conceives (measured by subtracting 9 months from the date of delivery) and 0 in the preceding months for each respondent.

The two hazards of getting married and conceiving the first child during month *t* for individual *i* are estimated using two separate *cloglog* discrete time hazard functions. The hazard functions for the probability that respondent *i* gets married or pregnant at time *t* are represented by h_i^m and h_i^c respectively, where:

$$(1)\quad \begin{aligned} \log[-\log(1-h_i^m(t))] &= \alpha D_i(t) + \beta_1 X_i + \beta_2 F_i^m(t) + \beta_3 P_i^m(t) + \varepsilon_i \\ \log[-\log(1-h_i^c(t))] &= \alpha D_i(t) + \beta_1 X_i + \beta_2 M_i^c(t) + \beta_3 F_i^c(t) + \beta_4 P_i^c(t) + \delta_i \end{aligned}$$

Di (t) is the baseline hazard, which in our case is a quadratic function at time *t* of the individual *i*'s duration (in age) between entry into the risk set (age 15) and the event under study (marriage or childbirth): $\alpha Di\ (t) = \alpha_0 + \alpha_1(age_i) + \alpha_2(age_i)^2$. *Xi* represents a set of observed time-constant variables measuring individual *i*'s observable characteristics that affect *i*'s transition to marriage and first birth. $M_i^c(t)$, which is only present in the childbearing equation, is a time-varying covariate identifying whether and when individual *i* is married. It takes on a value of 1 in the months in which individual *i* is married, and 0 otherwise. $F_i^m(t)$ and $P_i^m(t)$ are two additional time-varying variables indicating respectively how many friends or peers get married over time. $F_i^c(t)$ and $P_i^c(t)$ instead represent the time-varying variables measuring how many friends and peers become parents. In order to capture cross-friend influenced on fertility more appropriately, we consider the birth of the friend's child, not the time of conception. We did, however, also test whether there was a change if the event was backdated up to 6 months at the start of the cross-friend influence, but did not find any substantial change in the estimates. For the sake of simplicity and to address multicollinearity issues, we assume that friends' marriage behaviour only impacts an individual's risk of getting married (and not the one of becoming a parent), and vice versa, that an individual's risk of having the first child is only affected by friends' fertility outcomes (and not by friends' marital outcomes).

To measure cross-friend effects, we drew upon the so-called Susceptible-Infected-Susceptible (SIS) model (e.g., Pastor-Satorrás & Vespignani, 2001), used widely in

epidemiological studies. As in the SIS model, we assumed the contagion to be linear on the absolute number of "infected" (i.e., married or parents) friends. This means that the probability for the individual *i* of "being infected" only depends on the number of "infected" friends but not on the total number of friends the individual *i* has.

ε_i and δ_i represent the unobserved time-invariant individual-specific factors respectively influencing the risk of getting married and the one of having the first child. They are normally distributed random effects, with a zero mean and variance constrained to 1.

We had to fix the variance of the two process-specific random effects (ε_i and δ_i) because we did not have repeated events for each individual *i*, that could bring enough intra-individual variation and therefore allow the proper identification of the random variables' variance. We engaged in a sensitivity analysis of the estimates to assess the most appropriate values of the variance of these random effects. The size of the covariates' effects were affected by changes in the variance's chosen value, whereas the direction and the significance were very much consistent over our experiments. In line with Baizán et al. (2003, 2004), we adopted a value of 1 for both variances of the two random effects.

Entry into marriage and parenthood as two interrelated processes: A multiprocess model

Until now, we have assumed entry into first marriage and entry into parenthood as two independent transitions, thereby constraining the correlation between the random variables of the two hazard functions to be zero. In order to estimate the two processes simultaneously and, thereby taking into account cross-process unobserved heterogeneity at the individual level, we engaged in a multiprocess system (Equation 2),

$$(2)\quad \begin{cases} \log[-\log(1-h_i^m(t))] = \alpha D_i(t) + \beta_1 X_i + \beta_2 F_i^m(t) + \beta_3 P_i^m(t) + \varepsilon_i \\ \log[-\log(1-h_i^c(t))] = \alpha D_i(t) + \beta_1 X_i + \beta_2 M_i^c(t) + \beta_3 F_i^c(t) + \beta_4 P_i^c(t) + \delta_i \end{cases}$$

in which the two random variables ε_i and δ_i are assumed to have a joint bivariate normal distribution:

$$(3)\quad \begin{pmatrix} \varepsilon \\ \delta \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho_{\varepsilon\delta} \\ \rho_{\varepsilon\delta} & 1 \end{pmatrix} \right)$$

$\rho_{\varepsilon\delta}$ is the correlation between the unobserved heterogeneity terms of the two equations in the system (Equation 2). We implemented the model using the software MLwiN 2.24, which performed the estimation using restricted maximum likelihood (RIGLS algorithm, Rasbash et al., 2004).

Following Lillard, Brien, & Waite (1995), Upchurch et al. (2002) and Steele et al. (2005), our multiprocess model is identified under the assumption that every source of correlation among the two processes under study are fully represented by cross-process correlation between individual-level residuals. Although we did not engage in a recurrent event model, by fixing the values of the variance of the two random variables ε_i and δ_i, our model could be identified without using any exclusion restriction. This model only includes the effect of previous marital outcomes on the fertility hazard, but does not include any structural effect of the hazard of having a child on the hazard of marriage transition. However, although not strictly necessary, our two equations do include covariates that specifically affect only one process (i.e., event-specific cross-friend effects). Moreover, following once again Baizán et al. (2004), we also experimented with including the control variable measuring the number of siblings only in the fertility hazard and not in the hazard of marriage, but results did not change.

Covariates and control variables

In addition to controlling for unobserved time-invariant individual factors (by means of estimating random effects) and therefore preventing possible selection effects over time, we also included observable time-invariant as well as time-varying variables. We identified some factors that might confound cross-friend interaction effects on the risk of getting married and having a first child. Specifically, we controlled for relevant socio-demographic individual characteristics (measured at Wave I), namely, race, parental education, income, religiosity and family type. For race, we distinguished between Black and non-Black (in preliminary analyses we also looked at Hispanics as a separate category, but because it was a small group and not significantly different from Whites, we merged Whites and Hispanics into one category). Parental education is identified using a dummy variable indicating when at least one parent has obtained at least a college education; parental income is measured using quintiles; parental religiosity is expressed by a dummy variable that takes on value 1 when parents state that they have gone to religious services at least once a week in the past year. Finally, family type is measured using a dummy variable which takes the value of 1 in the case of an intact family (i.e., child is residing with both parents who are alive at Wave 1) and 0 in the case of a single-parent family or step-family.

We also took into account the number of current friends at Wave III as a proxy of an individual's friendship network's size, which might affect her social life and in turn her family formation strategy. Moreover, besides including age as a measure of the baseline time profile, in which we assumed to be quadratic, we also included marital status as a time-varying covariate in the childbearing equation.

6.6 Results

Descriptive results

The descriptive results provide initial interesting insights into which individual characteristics are associated respectively with the transition to marriage and parenthood among young adults. Table 1 reports descriptive statistics of the entire sample (last column). Here it is divided into two sub-samples of women who experienced their first marriage within the observation period and those that remained unmarried by Wave IV ('marriage' columns in Table 1). We followed the same procedure for parenthood, identifying the two groups of parents and non-parents during the observation window ('childbearing' columns of Table 1). The four groups differ in compositional characteristics. We are specifically interested in uncovering the main characteristics associated with entry into marriage and parenthood respectively by the age of 30 and how compositionally similar (or different) the two groups of wives and mothers are.

Turning first to the bottom part of Table 1, we see that within our sample, the majority (63.5%) of women who get married also become mothers before the end of observation. Similarly, 53.8% of women who become mothers by the age of 30 are married. Among the share of unmarried mothers, there are of course both single mothers as well as cohabiting women. As we expected, therefore, at the descriptive level we find a positive association between marriage and childbearing.

In line with the most recent U.S. official statistics (U.S. Census Bureau, 2012), the median age at the conception of the first child, which is 26.67, is smaller than the median age at first marriage (28.08).

Compared to those who have not had children, young mothers are more likely to come from a low socioeconomic status, measured in terms of parental education and family income at Wave I. Moreover, they are less likely to grow up in a family with both biological parents and they have, on average, more siblings. Although these patterns can be observed in the comparison between (still) single and married women as well, they are much less pronounced. Therefore, a lower socio-economic status is more likely to be associated with early motherhood than early marriage. Young adults coming from a religious family background are, conversely, slightly more likely to marry early as opposed to becoming young mothers. However, the main difference between the groups of 'wives' and 'mothers' rests with race. The percentage of Blacks among early mothers is higher than women with no children, but it is definitely lower among married than singles. We do not observe substantial differences across groups in the number of friends at Wave III; each group has an average number of friends of around 0.8 and an average number of peers of around 3.5. Therefore, these results do not provide evidence of substantial differences in the number of network relationships across groups.

Table 1: Descriptive statistics of the sample

	Marriage		Childbearing		Total
	Single	Married	Childless	Mothers	
Parent education					
Less than high school	10.2	10.4	8.0	13.2	10.3
High school or equivalent	31.8	34.1	27.7	38.8	32.6
Some college	18.2	20.3	18.9	19.0	19.0
College education or more	30.5	26.1	37.8	17.6	28.8
Unknown	9.3	9.1	7.5	11.4	9.2
Family type					
Living with both parents at Wave I	53.5	56.4	63.1	43.9	54.6
Living in a step family at Wave I	9.3	10.7	7.5	12.8	9.8
Living with single mother at Wave I	30.0	27.5	24.4	34.9	29.1
Living with single father at Wave I	2.3	1.8	1.6	2.7	2.1
Living in other type of family at Wave I	4.9	3.6	3.5	5.6	4.4
Parental religiosity					
Low/not religious	65.9	63.3	62.8	67.6	65.9
High	34.1	36.7	37.2	32.4	35.1
Race					
Hispanic	9.5	11.1	9.3	11.1	10.1
Black	33.6	13.5	21.9	31.2	26.1
Asian	5.6	2.5	6.2	2.3	4.5
White	51.3	72.9	62.5	55.5	59.4
Parental income					
1st quintile	23.2	21.8	17.6	29.3	22.6
2nd quintile	20.5	20.0	16.5	25.3	20.3
3rd quintile	20.3	23.9	21.7	21.6	21.6
4th quintile	17.4	19.1	20.3	15.1	18.1
5th quintile	18.8	15.2	24.0	8.8	17.4
Average number of siblings	1.53	1.57	1.49	1.70	1.55
Average number of friends (Min:0; Max:6)	0.76	0.80	0.78	0.76	0.78
Average number of peers (Min: 0; Max:10)	3.65	3.50	3.41	3.57	3.51
Mothers	32.7	63.5	-	-	44.2
Married	-	-	24.5	53.8	37.5
Median age at first marriage	-	28.08	-	-	-
Median age at first birth	-	-	-	26.67	-
Number of women observed	1190	713	1061	842	1903

Results of the two independent hazard models for marriage and parenthood

Estimates of the two independent *hazard* models for the risk of getting married and becoming a parent are shown in Table 2. Net of the baseline hazard and the control variables' effect, we find no cross-friend influences on an individual's risk of getting married. Specifically, an increasing number of friends who enter matrimony do not raise an individual's risk to marry. We do, however, find a significant contextual effect, evident from the positive effect on that risk of an increasing number of peers (i.e. non-friends,

former school mates) who get married. Therefore, our first hypothesis is not supported by the data. On the other hand, the fact that former school mates influence an individual's propensity to marry is very much in line with Hernes (1972) findings, showing that the greater the shared of married peers within a cohort, the higher the risk of getting married for individuals in such a cohort. He specifically argues that people are affected by social pressure exerted by peers of around the same age (like in our case, as we define an individual's peers as her former school mates), because social interaction is assumed to be age-graded (see also Nazio & Blossfeld, 2003). Of course, besides social pressure, other confounding contextual forces might be at play, such as a pure aging effect, or the simple fact that former school mates come from the same geographical area with a similar socio-economic status, which might shape each individual's propensity to marry at the same time.

Turning again to Table 2, we can see that our findings support our second hypothesis, because results of the *hazard* model for fertility show that an individual is more at risk of becoming a mother when the number of friends who are parents increases. This finding is in line with previous studies that find evidence of social interaction effects on fertility decision-making, looking at siblings (Kuziemko, 2006; Lyngstad & Prskawetz, 2010), co-workers (Hensvik & Nilsson, 2010; Ciliberto et al., 2010), and dyads of friends (Balbo & Barban, 2012). No contextual effects are found on the propensity to have the first child. Different from marriage, peers' behaviour does not seem to be associated with an individual's fertility decisions.

Marital choices seem to be affected by contextual factors, and perhaps a general social pressure stemming from the fact that coetaneous people start to get married more and more, whereas the decision to become a parent is clearly more influenced by friends' behaviour. This difference might rest with the fact that parenthood brings about considerably more uncertainty as well as higher costs. Life changes associated with the transition to parenthood might be better borne and faced if they are shared with friends, which can be an abundant source of information. Synchronizing such a transition with friends, moreover, can be a good strategy to reduce relational costs, by minimizing the risk of being left alone.

Let us now turn to the baseline hazard and the effect of our control variables on the risk of marrying and becoming a parent. The duration pattern, as a quadratic function of an individual's age, shows a clear curvilinear shape for both family-formation behaviours. The positive effect of older age at marriage and first birth rate is coupled with a small negative effect of age squared indicating that the effect of an individuals' age becomes weaker or negative, the older the individual is. We observe an interesting, substantial difference in how race influences the two risks of getting married and having a child. Black women are more likely to become mothers earlier than non-Black ones, whereas the opposite was seen for the risk of getting married, with non-Black women more likely to experience an

Table 2: Coefficient estimates (fixed part only) of two independent complementary log-log (cloglog) discrete time hazards of getting married and becoming a parent

	Marriage			Childbearing		
	Coeff.	S.E.	Sig.	Coeff.	S.E.	Sig.
Constant	-30.900	3.457	***	-21.161	1.873	***
Age	1.985	0.315	***	1.460	0.182	***
Age squared	-0.038	0.007	***	-0.034	0.004	***
Black *(ref: non-black)*	-1.535	0.226	***	0.338	0.123	***
Intact family *(ref: other types of family)*	0.031	0.154		-0.326	0.110	***
1st income quintile *(ref: 5th income quintile)*	0.563	0.241	**	0.854	0.197	***
2nd income quintile	0.233	0.225		0.963	0.190	***
3rd income quintile	0.149	0.198		0.778	0.186	***
4th income quintile	0.100	0.201		0.486	0.195	**
Number of friends	-0.014	0.047		-0.049	0.036	
Parents min college ed *(ref: lower education)*	-0.132	0.140		-0.477	0.105	***
Parental religiosity *(ref: no)*	0.529	0.135	***	-0.187	0.117	
Number of siblings	0.022	0.055		0.109	0.037	***
Married *(ref: non married)*				1.549	0.130	***
Number of friends who became parents				0.234	0.091	**
Number of peers who became parents				0.053	0.041	
Number of friends who got married	0.149	0.112				
Number of peers who got married	0.103	0.051	**			
N	1903			1903		
Number of spells	149520			149520		

* p < 0.10. ** p < 0.05. *** p < 0.001

early marriage than Blacks, which in line with previous research (Edin & Reed, 2005). We also find that the higher the number of siblings, the younger the age at first birth, also confirming previous results (e.g., Rijken & Liefbroer, 2009). No similar effect is found for the marital decision.

Turning to the economic situation of the family of origin, we observe that women from low-income families have a higher risk of becoming parents sooner than those from a higher income family. This effect on the propensity to marry is not as clear-cut. Specifically, only people coming from a very disadvantaged family, that is, with a very low income, have a higher risk of getting married. This finding is in line with previous research (Uecker & Stokes, 2008). As far as parental education and family type are concerned, we find that they only shape the risk of becoming a parent, and not marriage. People who have more educated parents seem to have the first child later than those who come from a less educated family. Presumably, this effect is the result of the fact that the first group

of individuals is more likely to stay in education longer, thereby delaying the entry into parenthood (Rijken & Liefbroer, 2009). Individuals who grew up with both biological parents become parents later than those who resided in a step or single parent family.

On the other hand, parental religiosity only affects the risk of getting married. As expected and in line with existing research (Thornton et al., 1992), a religious family background increases the propensity to marry earlier. Finally, the positive close link between marital and childbearing decisions is evident from the fact that married women have a much higher risk of becoming mothers. Whether this effect captures only a causal relationship between the two decisions (from marriage to childbearing), or is the result of a spurious association, cannot be concluded using the model shown in Table 2. We therefore apply a multiprocess model to overcome this issue, controlling for possible unobserved heterogeneity common to the two processes.

Results of the multiprocess model

Table 3 and Table 4 report the respective estimates of the fixed and the random part of the multilevel process we estimated to take into account possible unobserved heterogeneity at the individual level affecting both processes, that is, the risk of entry into marriage and parenthood.

If we compare the estimates of the covariates' coefficients of the multiprocess model (Table 3) with those of the two independent models, we cannot find substantial differences in both processes. The effect of the control variables and the baseline hazard is consistent, although low parental income seems to have a slightly stronger impact on the propensity to marry in the multiprocess model. The only relevant, but expected change is in the effect of marital status on the risk of having a child. Table 3 shows a strong, positive correlation between the random effects of the two hazards, fully supporting our third hypotheses that the risk of entry into marriage and parenthood is partially determined by common individual factors, also found in previous studies (e.g., Baizán et al., 2003, 2004;. Aassve et al., 2006). As a consequence of the presence of a significant and rather high common unobserved heterogeneity (i.e., there are time-invariant subjective factors that affect both an individual's propensity to marry as well as the one to become a mother, see Table 4), the direct and independent effect of marital status on the risk of first birth is reduced, although it remains strong and highly significant. This suggests that marriage, net of common unmeasured individual family predispositions, has its own independent effect on childbearing, being perceived by a woman as the most appropriate setting to become a mother.

Our finding that the correlation between the unobserved heterogeneity of the two hazards is strong and positive indicates that transition to marriage and transition to parenthood can be considered as joint choices of a couple's unique underlying family-formation strategy. The presence of this positive correlation between these two decisions moreover suggests that those women who marry early likely become early mothers as well.

Table 3: Coefficient estimates (fixed part only) of a multiprocess model composed by two complementary log-log (cloglog) discrete time hazards of getting married and becoming a parent

	Marriage			Childbearing		
	Coeff.	S.E.	Sig.	Coeff.	S.E.	Sig.
Constant	-31.787	3.464	***	-20.901	1.867	***
Age	2.062	0.316	***	1.425	0.182	***
Age squared	-0.039	0.007	***	-0.033	0.004	***
Black *(ref: non-black)*	-1.448	0.224	***	0.310	0.123	**
Intact family *(ref: other types of family)*	0.003	0.153		-0.344	0.110	***
1st income quintile *(ref: 5th income quintile)*	0.634	0.238	***	0.860	0.197	***
2nd income quintile	0.309	0.222		1.002	0.190	***
3rd income quintile	0.201	0.197		0.782	0.186	***
4th income quintile	0.119	0.200		0.501	0.196	**
Number of friends	-0.018	0.047		-0.049	0.036	
Parents min college ed *(ref: lower education)*	-0.174	0.138		-0.475	0.105	***
Parental religiosity *(ref: no)*	0.460	0.134	***	-0.174	0.108	
Number of siblings	0.028	0.054		0.114	0.038	***
Married *(ref: non married)*				1.198	0.128	***
Number of friends who became parents				0.241	0.091	***
Number of peers who became parents				0.059	0.041	
Number of friends who got married	0.150	0.111				
Number of peers who got married	0.101	0.051	**			
N	1903			1903		
Number of spells	149520			149520		

* p < 0.10. ** p < 0.05. *** p < 0.001

As outlined previously in our theoretical section, it appears that different mechanisms regulate the impact of social interactions on marriage versus fertility. As peers have a stronger impact on marriage, one conclusion is that the social influence or pressure of seeing people around oneself entering into marriage is the central theoretical mechanism that regulates entry into marriage. Entry into parenthood, on the other hand, appears to be more influenced not by broader peer, but rather more immediate cross-friend effects. This is attributed not only to social learning and seeing how friends experience parenthood, but also the advantages of cost-sharing dynamics such as childcare. Previous studies have found that both social pressure, but also the perceived availability of childcare help and emotional support within one's social network results in higher fertility intentions for second and third births (Balbo & Mills, 2011). It may be that network externalities also play a role in fertility because individuals may derive a benefit of 'pooling' parental resources (e.g., joint childcare, taking turns driving children to activities) when more friends around them also increase their own 'consumption' (i.e., fertility).

Table 4: Estimated random-effect covariance matrix of the multiprocess modelent

	Marriage	Childbearing
Marriage	1	
Childbearing	0.561 (0.106) ***	1
	Corr. = 0.56	

* p < 0.10. ** p < 0.05. *** p < 0.001 from Wald test
Note: The reported values are the estimated variance of each random effect. The off-diagonal cell represents the covariance with standard error in parentheses and correlation between the two random effects.

Robustness check: the role of family religiosity

Some have claimed that the cultural shift towards individualization (Beck & Beck-Gernsheim, 2001; Uecker & Stockes, 2008), has led individuals to be less susceptible to social norms (Bumpass, 1990; Lesthaeghe & Surkyn, 1988). As Thornton and colleagues have argued (1992), however, certain groups may be more susceptible to social influences. People who come from religious families are likely to grow up in a religious environment and place a higher value of marriage, encourage early marriage and attach social recognition to it. To test the robustness of the previous models, we repeat the previous analysis with a subsample of respondents from religious families (i.e., defined as parents attending religious services at least once a week at Wave I). This group has two main characteristics that can be used to test the robustness of the previous findings. First, people with a religious background are more likely to follow a traditional family formation pattern. Cohabitation is less diffuse among people with higher religiosity and childbearing happens almost exclusively within marriage. Women from a religious family are more likely to marry in the observation period. Within the religious group 39.1% were married before Wave IV, whereas in the non-religious group, 36.5% married. This group of respondents is thus more likely to be influenced by marriage and less by other family formation patterns. For this reason, we expected that if cross-friend influences act through marriage rather than fertility, it would be particularly true for this selected group because childbearing outside marriage is less common.

Second, this group also differs in the composition of their peers and friends. Respondents from religious families are more likely to have religious friends who in turn are more likely to marry. Existing studies have shown that religiosity hastens marriage and religious people attach a higher value and strong symbolic meaning to marriage (Thornton et al., 1992; Uecker & Stockes, 2008). Women in this group have on average 0.4 friends who got married before Wave IV, whereas non-religious respondents have on average 0.2 friends who married. These respondents represent a select group in which marriage is the normative transition before childbearing. Although this group is highly selective on family attitudes and predisposition to marriage, they represent a suitable test to investigate if cross-friend influence on childbearing are confounded by cross-friend influences on marriage formation. This group consists of 669 women (35% of the entire sample).

Table 5: Coefficient estimates (fixed part only) of a multiprocess model composed by two complementary log-log (cloglog) discrete time hazards of getting married and becoming a parent only for the religious group.

	Marriage			Childbearing		
	Coeff.	S.E.	Sig.	Coeff.	S.E.	Sig.
Constant	-32.264	5.092	***	-19.033	3.035	***
Age	2.140	0.466	***	1.197	0.291	***
Age squared	-0.042	0.011	***	-0.027	0.007	***
Black *(ref: non-black)*	-1.296	0.280	***	0.331	0.191	*
Intact family *(ref: other types of family)*	0.082	0.254		-0.481	0.189	**
1st income quintile *(ref: 5th income quintile)*	0.852	0.407	**	0.755	0.343	**
2nd income quintile	0.691	0.338	**	1.130	0.311	***
3rd income quintile	0.389	0.302		0.773	0.305	**
4th income quintile	0.433	0.298		0.614	0.313	**
Number of friends	-0.051	0.065		-0.138	0.061	**
Parents min college ed *(ref: lower education)*	-0.062	0.211		-0.301	0.173	*
Number of siblings	0.018	0.072		0.093	0.055	*
Married *(ref: non married)*				1.293	0.190	***
Number of friends who became parents				0.315	0.136	**
Number of peers who became parents				0.092	0.065	
Number of friends who got married	0.285	0.135	**			
Number of peers who got married	0.126	0.074	*			
N	669			669		
Number of spells	59513			59513		

* p < 0.10. ** p < 0.05. *** p < 0.001

Table 6: Estimated random-effect covariance matrix of the multiprocess model for the religious group

	Marriage	Childbearing
Marriage	1	
Childbearing	0.766 (0.161) ***	1
	Corr. = 0.76	

* p < 0.10. ** p < 0.05. *** p < 0.001 from Wald test
Note: The reported values are the estimated variance of each random effect. The off-diagonal cell represents the covariance with standard error in parentheses and correlation between the two random effects.

The previous analyses are repeated with this more selective group of women from religious families and reported in Table 5 and 6. Results show that peers and friends positively influence the timing of marriage. In particular, in contrast with the results using the entire sample, friends have a significant effect on the probability to marry. As expected, among this selected group of respondents, the social influence of marriage is stronger than in the entire sample. Nevertheless, the cross-friend influence on childbearing remains strongly significant even if the cross-influence also acts on the marriage behaviour. This indicates that friends influence childbearing net of their influence of union formation behaviour. It is also interesting to note that the correlation on the unobserved heterogeneity of the two processes is higher than with the entire sample (see Table 6). This corroborates our hypothesis that marriage and childbearing are affected by common unobserved factors, which we can empirically demonstrate are particularly strong in a more selected group. Overall, these results confirm that family formation and childbearing are influenced by friends' behaviour. Our results show that cross-friend influences are present also when marriage is more important and normative within a group. This represents a robustness check of the previous analysis, because for the entire sample, marriage is not the exclusive pattern of family formation and childbearing can precede family formation.

6.7 Conclusion

This study extended existing research on the impact of social interaction effects on demographic behavior by examining the extent to which friends' and peers' behaviour influences the entry into marriage and parenthood. Using the four Waves of the Add Health survey, we first engaged in independent discrete-time event history models (*cloglog*) with random effects at the individual level to estimate the risk of entry into marriage and parenthood. In a second step, we implemented a multiprocess model (Lillard, 1993; Baizán et al. 2003; 2004; Steele et al., 2005; 2006) to empirically test whether an individual's underlying marital and parenthood decision were jointly taken.

By exploiting the Add Health network design, we were able to distinguish an individual's friends from peers (i.e., former school mates not defined as friends who simply shared the same social context). This provided us with the unique opportunity to estimate both cross-friend and cross-peer effects on the hazard of entry into marriage and parenthood and in addition to separate true cross-friend influences from contextual effects.

Results showed a strong and significant cross-friend effect on entry into parenthood, with no impact of friends for marriage. In fact, an increasing number of friends who get married do not seem to raise an individual's propensity to marry, unless that person comes from a religious family. This latter finding is likely related to the higher levels of social pressure and social recognition that marriage brings in this group.

To reflect upon and interpret these findings, we turn to the first contribution of this study, which was the further theoretical development of four potential theoretical mechanisms –

social influence and learning, cost-sharing dynamics and network externalities – to describe how social interaction might impact entry into marriage and parenthood differently. Marriage and parenthood are associated with very different levels of uncertainty and costs, which we anticipated would be very different processes. A central finding was that because peers have a stronger impact on marriage, social influence or pressure appears to be the central explanatory mechanism. For entry into parenthood, however, cross-friend effects were paramount, which was related to social learning, but also cost-sharing dynamics and the benefit of 'pooling' parental resources in the form of network externalities.

A second contribution was empirical in nature, which is the fact that we not only considered the entry into marriage and parenthood as two independent transitions, which is often the case in existing literature, but also modelled them as two joint outcomes of a common underlying family-formation strategy. This is in line with existing literature which has demonstrated that marital and fertility decisions are highly interdependent as they are both simultaneously affected by common unobserved inter-individual heterogeneity (Lillard, 1993; Upchurch et al., 2002 Baizán et al. 2003, 2004; Steele et al., 2005, 2006, Aassve et al., 2006). By focusing on the conventional pathway in which an individual first experiences marriage followed by parenthood, we adopted a multiprocess model to uncover a positive correlation between unobserved subjective factors that simultaneously affected the decision to marry and become a parent.

Although the current study offers new insights, we are also aware of some of its limitations. First of all, in a society were cohabitation is increasingly widespread (Smock, Casper & Wyse, 2008), the fact that we could not take this type of union into account inevitably leads to a somewhat incomplete picture of the broader family formation process among American youth. The lack of cross-friend effects on marriage might indeed also be the result of the spread of cohabitation, which might operate as a competing event. It would be desirable for further research on social interaction to take this transition into account, which was not possible in the current study. Other minor limitations are related to data constraints that we faced, such as the small sample size, the inability to carry out recurrent event models or the difficulty to find a valid exclusion restriction in our multiprocess model that could allow us to also look into the reverse pathway of the effect of prior childbearing on marriage. These are all aspects that we hope future research can overcome, hopefully with the use of new network-based panel data, that at the moment, with a few exceptions such as the Add Health study, remain lacking. In spite of the abovementioned limitations, we believe this study is a first important step towards a more thorough knowledge and deeper understanding of how social interaction can differently impact diverse life-course transitions. If researchers as well as policy-makers believe in the shaping force of social interaction and diffusion processes, that can also modify the results of family-policies, a more detailed knowledge of how social interaction influence different demographic events is necessary.

Samenvatting

In dit boek wordt een belangrijke nieuwe verklaring van vruchtbaarheidsgedrag ontwikkeld. De nadruk in deze nieuwe benadering ligt op het meso-niveau, dus op factoren die relatie hebben met het netwerk van de informele relaties die iemand deelt met familie en vrienden (d.w.z. het sociale netwerk van een individu). De voornaamste aspecten die een rol spelen op dit meso-niveau worden door ons geïdentificeerd. Omdat aan ieder van deze aspecten belangrijke mechanismen ten grondslag liggen, wordt voor ieder van deze meso-level aspecten die onderliggende mechanismen onderzocht. Zodoende ontwikkelt dit onderzoek belangrijk inzicht in de vraag waarom mensen wel of geen kinderen nemen.

Dit ambitieuze doel kan gerealiseerd worden door verschillende onderdelen en aspecten van het sociale netwerk onder de loep te nemen. Daarom beschouwen wij niet alleen de rol die netwerken spelen in de toegang tot waardevolle hulpbronnen (Hoofdstuk 3 en 4), maar zien wij een sociaal netwerk ook als de ruimte waarin mensen worden blootgesteld aan de meningen en het gedrag van anderen (Hoofdstuk 3 t/m 6). We houden er tevens rekening mee dat een sociaal netwerk uit verschillende soorten mensen bestaat. Na een korte blik op het algemene sociale netwerk van een individu - waarin geen onderscheid wordt gemaakt tussen verschillende types actoren in het sociale netwerk (Hoofdstuk 3) – verleggen wij de focus naar verschillende typen actoren, namelijk familie, broers en zussen, vrienden en peers.

Naast onze nadruk op de verschillende aspecten van het sociale netwerk van het individu hanteren wij tevens een multi-dimensioneel begrip van vruchtbaarheid. Wij doen dit door de rol van het sociale netwerk op verschillende dimensies van vruchtbaarheid in ogenschouw te nemen. Op basis van de Theory of Planned Behavior (Ajzen, 1991), beschouwen wij het krijgen van een kind als een gevolg van doelgericht gedrag, dat als zodanig het resultaat is een van rationeel en intentioneel proces van individuele besluitvorming. Om het volledige proces van besluitvorming - van begin tot einde - te kunnen bestuderen moet uitgebreid aandacht worden besteed aan ieder van de drie elementen die dit proces omvatten. Om deze reden kijken we zowel naar de vorming van de intentie om een kind te nemen (Hoofdstuk 3), naar het realiseren van die intentie (hierbij expliciet kijkend naar de kloof tussen intentie en gedrag (Hoofdstuk 4)) en naar het uiteindelijke gedrag (Hoofdstuk 5 en 6). Tevens - aangezien de keuze voor kinderen zowel het aantal kinderen omvat (quantum), als de timing (tempo) - worden zowel *quantum* als het *tempo* in ogenschouw genomen. We onderzoeken eerst de intentie tot een eerste of hogere-orde geboorte en daarna de realisatie (Hoofdstuk 3 en 4). Vervolgens kijken we naar de timing van geboortes (Hoofdstuk 5 en 6). Omdat er een sterke samenhang

is tussen het huwelijk en de keuze om kinderen te nemen - zowel in de timing als in de levensplanning die ze omvatten - nemen wij de wederzijdse afhankelijkheidsrelatie tussen het huwelijk en ouderschap ook mee in onze benadering.

Hoofdstuk 2 geeft een systematische en uitgebreide beschouwing van het bestaande onderzoek naar vruchtbaarheidsgedrag en legt als zodanig het theoretische fundament voor de empirische studies die volgen. Dit overzicht is van essentieel belang om een beeld te krijgen van wat er reeds bekend is en wat er nog ontdekt moet worden. Bestaand onderzoek wordt in deze terugblik geclassificeerd aan de hand van de voornaamste determinanten van vruchtbaarheidsgedrag. Deze factoren worden gegroepeerd aan de hand van het analytische niveau waarop ze actief zijn (micro-, meso- of macro-niveau factoren). Hoewel het doel ook is om een bruikbare categorisatie van bestaand onderzoek naar vruchtbaarheid te geven, onderstreept deze review ook de beperkte hoeveelheid onderzoek op het meso-niveau - het niveau van sociale relaties. We proberen tevens om deze laatste stroom van onderzoek te plaatsen in de bredere context van het onderzoek naar vruchtbaarheid. Hierdoor worden verschillende relaties met onderzoeken op het micro- en macro-niveau geïdentificeerd.

In *Hoofdstuk 3* wordt onderzocht of het ervaren van sociale druk en het ontvangen van sociaal kapitaal van familie, vrienden en peers invloed heeft op de intentie om een tweede of derde kind te nemen. We verwachten dat hoe hoger de sociale druk hoe waarschijnlijker de wens is om een tweede of derde kind te nemen. We gebruiken hiervoor de Generations and Gender Survey (GGS) data en de resultaten steunen de hypotheses. Tevens testen wij een niet lineaire relatie tussen sociaal kapitaal – geoperationaliseerd in termen van ontvangen emotionele steun en ontvangen informele kinderopvang – en de intentie om nog een kind te nemen. Een tweede belangrijke uitbreiding op bestaand onderzoek is de evaluatie van cross-nationale verschillen (tussen Frankrijk, Duitsland en Bulgarije) in de impact van sociale druk en sociaal kapitaal op de intentie om (meer) kinderen te nemen. Resultaten laten zien dat er sprake is van een 'institutionele filter': de impact van beide factoren is groter naarmate families minder steun krijgt van de welzijnsinstituties.

Hoofdstuk 4 legt de relatie tussen sociale netwerken en kinderwens bloot. We onderzoeken of er sprake is van sociale beïnvloeding in vruchtbaarheidsgedrag en waarom dat zo is. Hierbij kijken we niet alleen naar de invloed van familierelaties maar ook naar beïnvloeding door het gedrag van broers en zussen. Twee concurrerende verklaringen over de rol van sociaal kapitaal in families worden onderzocht. Hierbij kijken we zowel naar een faciliterende dan wel remmende rol van sociaal kapitaal op de realisatie van intenties, als naar de gevolgen van sociaal kapitaal voor de impact van relaties tussen broers en zussen. We gebruiken twee waves van de Nederlandse Kinship Panel Survey (NKPS), een studie naar familierelaties in Nederland. Daarnaast introduceren we een belangrijke methodologische vernieuwing door te onderzoeken of het opnemen van alleen subjecten met positieve vruchtbaarheidsintenties – in voorgaand onderzoek –

tot een problematische selectie bias leidde. Door een model te gebruiken dat rekening houdt met sample selectie, ontwijken we niet alleen dit selectie probleem, maar testen we tevens of er inderdaad sprake is van een selectie bias. De resultaten laten zien dat er enige, zij het verwaarloosbare, niet-geobserveerde karakteristieken zijn die invloed hebben op zowel iemand zijn vruchtbaarheidsintenties als de realisatie van deze intenties. Een grote hoeveelheid sociaal kapitaal heeft tot gevolg dat mensen er vanaf zien om een kind te nemen, vooral wanneer individuen reeds een kind hebben. Mensen hanteren, zo lijkt het, een 'strategie van bevrediging' (d.w.z. een keuze-strategie waarin – slechts – het bereiken van een minimale standaard wordt nagestreefd). Onze resultaten laten ook zien dat kinderen een middel kunnen zijn om sociaal kapitaal voor de familie te genereren. Tot slot blijkt dat het hebben van een broer of zus met een jong kind samenhangt met een hogere waarschijnlijkheid om de eigen kinderwens te realiseren.

Hoofdstuk 5 onderzoekt hoe sociale interacties tussen vrienden vruchtbaarheidsgedrag beïnvloeden. De focus ligt hierbij op Amerikaanse jongvolwassenen. We onderzoeken of het vruchtbaarheidsgedrag van vrienden invloed heeft op de eigen transitie naar ouderschap en onderzoeken tevens waarom dat zo is. Hier integreren we economische en sociologische theorie en extraheren hieruit het mechanisme dat aan sociale beïnvloeding van vruchtbaarheidsgedrag door vrienden ten grondslag ligt. Door gebruik te maken van het survey design van de National Longitudinal Study of Adolescent Health (Add Health), zijn we in staat om interactie-effecten correct te identificeren, omdat we hen kunnen onderscheiden van verborgen effecten (d.w.z. selectie en contextuele effecten). Hiervoor gebruiken wij een serie van discrete time event history models met randoms effects op dyadisch niveau. Resultaten laten zien dat, na controle voor contextuele effecten, het hebben van een vriend met kinderen de eigen kans om een kind te krijgen vergroot. Wij vinden een curvilinear kortetermijneffect: de individuele kans op een kind neemt direct toe na de geboorte van een kind bij vrienden, heeft zijn piek twee jaar later en neemt daarna weer af.

Hoofdstuk 6 onderzoekt welke invloed het gedrag van vrienden en peers heeft op vruchtbaarheidsgedrag en huwelijksgedrag. Wij onderzoeken deze invloed tijdens de transitie naar volwassenheid van jongvolwassenen Amerikanen. Na eerst de transitie naar het eerste huwelijk en de transitie naar ouderschap los van elkaar te bestuderen, bestuderen we ze later als een wederzijds afhankelijk proces. Als zodanig beschouwen we beide als het gezamenlijk resultaat van één, voor ieder individu unieke, onderliggende familievormingsstrategie. Op basis van de National Longitudinal Study of Adolescent Health (Add Health), gebruiken we een aantal discrete time event history models om te testen of het inderdaad zo is dat individuen met een grote hoeveelheid vrienden en peers die getrouwd zijn (of één of meer kinderen hebben), zelf ook sneller trouwen (of kinderen nemen). Resultaten laten een sterk effect zien tussen vrienden op de transitie naar ouderschap. De transitie naar een huwelijk wordt echter alleen beïnvloed door peers.

De resultaten van een multi-process model laten tevens zien dat effecten tussen vrienden in de transitie naar ouderschap sterk significant blijven, zelfs wanneer er statistisch gecontroleerd wordt voor niet-geobserveerde heterogeniteit tussen de processen.

Concluderend: Ieder empirisch hoofdstuk van dit boek onthult een ander belangrijk aspect van de invloed van sociale netwerken en interpersoonlijke relaties op het besluitvormingsproces rond het krijgen van kinderen. De algemene conclusie die op basis van het gepresenteerde onderzoek kan worden getrokken is dat sociale netwerken een cruciale drijvende kracht vormen die een sterk vormende werking hebben op het gehele vruchtbaarheid gerelateerde besluitvormingsproces, van begin (de totstandkoming van de intentie om een kind te nemen) tot de uiteindelijke uitkomst (het uiteindelijke gedrag) en zowel in de *quantum* (d.w.z. of men besluit om (nog) een kind te nemen) en het *tempo* (d.w.z. wanneer men een kind neemt).

In dit boek laten wij zien dat sociale netwerken invloed hebben op vruchtbaarheid op verschillende manieren. Een diversiteit aan dimensies, kanalen, mechanismen en actoren moet in ogenschouw worden genomen om de invloed van sociale netwerken op vruchtbaarheid te begrijpen.

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Curriculum Vitae

Nicoletta Balbo was born in Sao Paolo, Brazil, on May 21, 1982. She earned her Bachelor degree in Business Administration and Management from Bocconi University, Milan, Italy, in 2005. She then studied Economics and Social Sciences again at Bocconi University, where she obtained her Master of Science degree (cum laude) in 2008, writing a thesis on fertility trends in Georgia. During her Master progam, Nicoletta worked as an intern for the Population Activities Unit of the United Nations in Geneva, contributing to an international research project entitled "Generations and Gender Programme". In 2008, she worked as a research assistant at the C. Dondena Centre for Research on Social Dynamics, at Bocconi University, where she continued working on the "Generations and Gender Programme". In September 2008, Nicoletta joined the Interuniversity Centre for Social Science Theory and Methodology (ICS), at the University of Groningen, the Netherlands, where for the next four years she held a position as Doctoral Researcher and conducted research on social networks and fertility. Since October 2012, Nicoletta is working as a Postdoctoral Researcher for the Dondena Centre at Bocconi University. Her current research focuses on the relationship between happiness and fertility.

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